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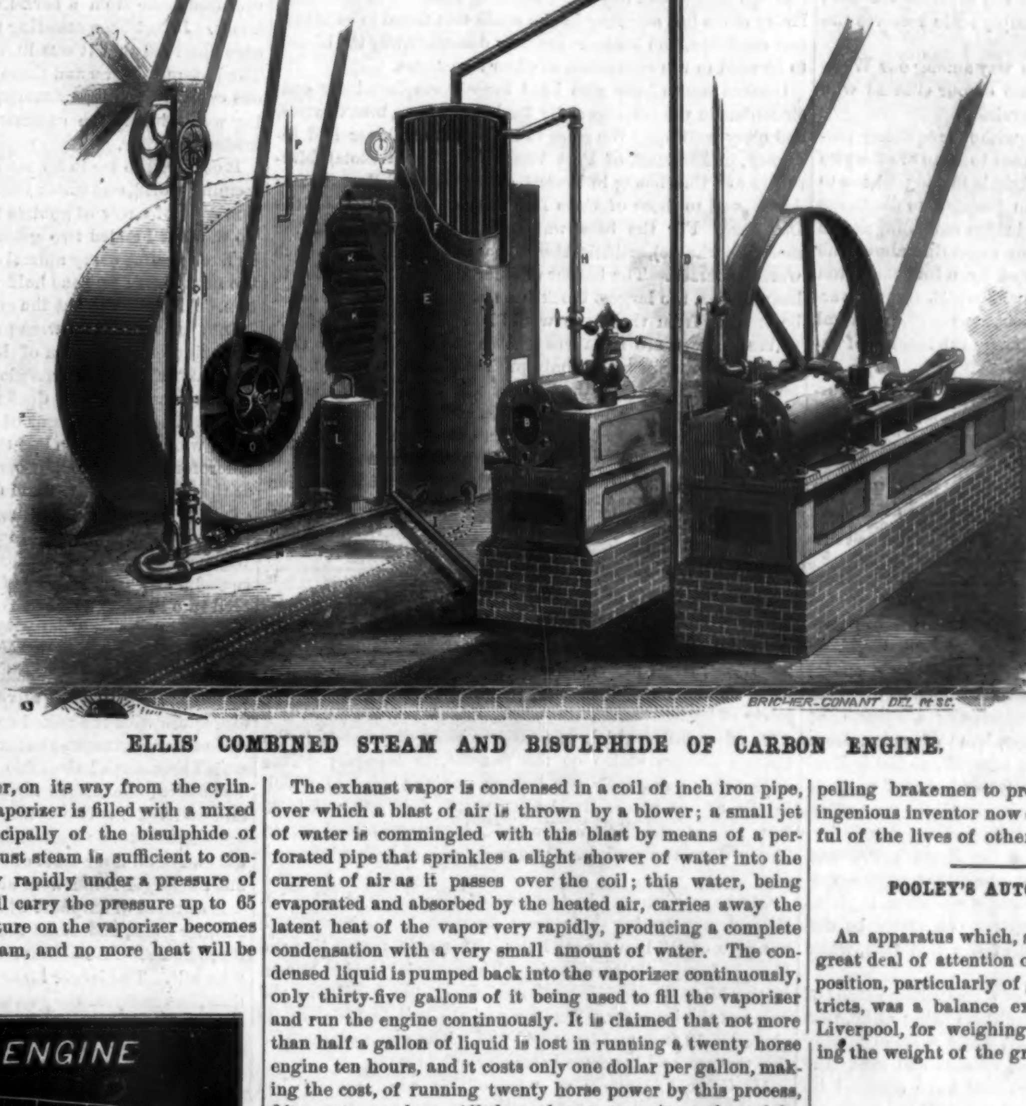
GREAT REDUCTION IN COST OF STEAM POWER—REMARKABLE RESULTS.

A trial is being made at the Atlantic Works, in Boston, of Ellis' method of using the latent heat in exhaust steam to produce power by the vaporization of bisulphide of carbon, which, according to information furnished us, is showing very surprising results. The remarkable statement is put put forth by the inventor that the fuel, now required to produce one hundred horse power, will, with a proper application of the heat in the exhaust steam, produce two hundred and sixty-six horse power; showing a gain of one hundred and sixty-six per cent amount of power obtained by the use of this method, which has been once before referred to in journal. (See Vol. XXIV., page 79.)

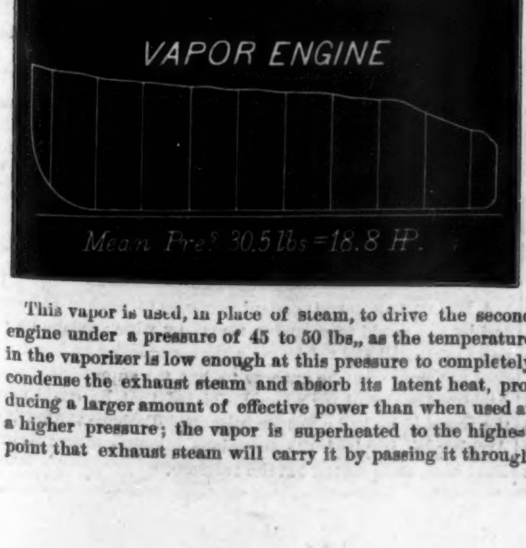
It is claimed that the exhaust from an engine of one hundred horse power can be taken to an adjoining building and used to heat a bisulphide of carbon boiler, which will furnish vapor sufficient to drive an engine of one hundred and sixty-six horse power to its full capacity. No back pressure or other injurious effect is produced on the first engine by using its exhaust to heat the boiler of the second one; or, by coupling these engines together, a machine of two hundred and sixty-six horse power is obtained, driven by the same fire previously required to produce one hundred horse power; as evidence of which, the subjoined indicator diagrams have been sent us.

For the purposes of experiment, two new engines, made from the same patterns in the same manner, are used, the arrangement of the engines being shown in the accompanying engraving.



ELLIS' COMBINED STEAM AND BISULPHIDE OF CARBON ENGINE.

They are ten inches internal diameter, and twenty-four inches stroke, with single valves. One of them is run by steam in the usual manner, and its exhaust is passed through the flues of a vaporizer, on its way from the cylinder to the atmosphere. This vaporizer is filled with a mixed volatile liquid, consisting principally of the bisulphide of carbon. The heat of the exhaust steam is sufficient to convert this liquid into vapor very rapidly under a pressure of 45 to 50 lbs. to the inch, and will carry the pressure up to 65 lbs. At this point the temperature on the vaporizer becomes equal to that of the exhaust steam, and no more heat will be imparted to it.



This vapor is used, in place of steam, to drive the second engine under a pressure of 45 to 50 lbs., as the temperature in the vaporizer is low enough at this pressure to completely condense the exhaust steam and absorb its latent heat, producing a larger amount of effective power than when used at a higher pressure; the vapor is superheated to the highest point that exhaust steam will carry it by passing it through a superheater, surrounded by exhaust steam, in its passage from the vaporizer to the cylinder.

The annexed diagrams, taken from these two engines at the same time, while at their regular work, by Mr. Snell, the mechanical engineer at the Atlantic Works, are the ones referred to as showing the amount of power developed by each.

It will be seen that the vapor engine, whose boiler was heated entirely by the exhaust from the steam engine, gave 18·8 horse power, while the steam engine gave only 11·3 horse power; and that the same fire, required to produce 11·3 horse power with steam used in the usual manner, produced 30·1 horse power when the heat in the exhaust steam was used in the method described, showing a gain of one hundred and sixty-six per cent in power, as above stated.

The exhaust vapor is condensed in a coil of inch iron pipe, over which a blast of air is thrown by a blower; a small jet of water is commingled with this blast by means of a perforated pipe that sprinkles a slight shower of water into the current of air as it passes over the coil; this water, being evaporated and absorbed by the heated air, carries away the latent heat of the vapor very rapidly, producing a complete condensation with a very small amount of water. The condensed liquid is pumped back into the vaporizer continuously, only thirty-five gallons of it being used to fill the vaporizer and run the engine continuously. It is claimed that not more than half a gallon of liquid is lost in running a twenty horse engine ten hours, and it costs only one dollar per gallon, making the cost, of running twenty horse power by this process, fifty cents per day. All the exhaust steam is condensed by this process, and pure hot water furnished for the steam boiler, dispensing with a heater and avoiding all scale and sediment in the steam boiler.

It is claimed that engines now in use can be arranged to use this process and made to produce more than double the power with the same fuel, or the same power with less than half the fuel, as may be desired. The steam from salt blocks sugar evaporators, etc., can be used to produce power by this process equally as well as the exhaust from an engine.

Where two establishments, using steam power, are near each other, the exhaust steam from one can be taken to heat the boiler of the other, and no fuel, fireman, chimney, fire box, or grate, will be required for this latter boiler; and its engine will run continuously, like a water wheel, without attention, as long as the supply of exhaust steam is furnished. There will be no risk of an explosion, as the heat of the exhaust will not carry the pressure in the boiler above 65 lbs. under any circumstances, and if all the liquid should be evaporated out of the boiler, no injury would be done, as it would not be overheated or injured by the heat of exhaust steam. The vapor engine does not require any oiling of the cylinder, valves, or rods, the fluid evaporated lubricating the parts, so that the friction and wear are, it is claimed, considerably less than that of a steam engine.

The Ellis Vapor Engine Company, of Boston, are manufacturing engines and fixtures constructed on this plan, and guarantee them to produce as much power as any other engine made, with less than half the fuel. Further information can be obtained by addressing them at 100 Summer street, Boston.

The trial engines can be seen running at the Allaire Works in Boston, at all times. We give these statements as they have been made to us, simply remarking that the results claimed are theoretically possible, and that the practical difficulties which prevented their realization by previous experimenters have been ably met, and seemingly overcome, by the inventor and patentee, Mr. J. H. Ellis, who has protected his improvement by a number of patents, obtained through the Scientific American Patent Agency, in this country and Europe, and who now has other applications pending. The results shown by the indicator diagrams are certainly very remarkable, and will at once challenge the attention of engineers.

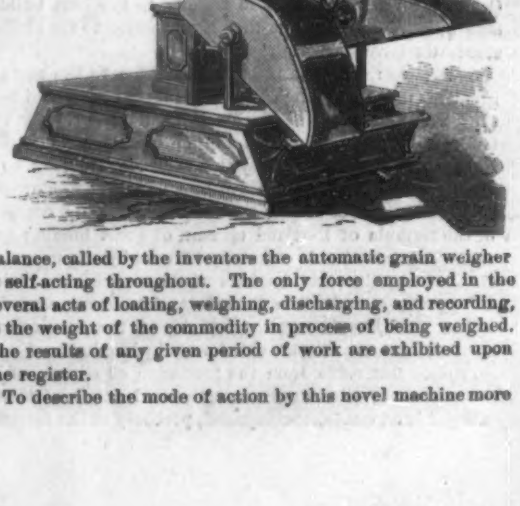
Novel Railway Signal.

Men are now engaged in erecting novel danger signals at every bridge and tunnel on the Hudson River Railroad, to warn brakemen, who are compelled at times to run along on the tops of trains, of their near approach to such dangerous places. A pole is erected by the side of the track, and an arm projects from it at the top over the track. From this arm hangs a wire fringe, low enough to strike a brakeman on the front piece of the cap or against the face if he is standing up as the train passes. This perceptibly notifies him that he is only one hundred feet from the bridge or tunnel, and must lie down at once. The blow inflicted by the fringe is momentarily a stinging one, but produces no evil results.

This is a novel way of compelling brakemen to protect their own lives. Cannot some ingenious inventor now devise something to make them careful of the lives of others?

POOLEY'S AUTOMATIC GRAIN WEIGHER.

An apparatus which, says Dr. Barnard's Report, attracted a great deal of attention of American visitors to the Paris Exposition, particularly of gentlemen from our agricultural districts, was a balance exhibited by Henry Pooley & Son, of Liverpool, for weighing grain and at the same time recording the weight of the grain which has been weighed. This



balance, called by the inventors the automatic grain weigher is self-acting throughout. The only force employed in the several acts of loading, weighing, discharging, and recording, is the weight of the commodity in process of being weighed. The results of any given period of work are exhibited upon the register.

To describe the mode of action by this novel machine more

in detail: the grain is introduced to the machine from the depot in any manner by which a continuous supply may be conveniently delivered into the feeder; then, when the first scale has received the principal part of its load, that scale falls through a portion of its descent, and in falling lifts a proportional weight equal to the partial load then in the scale, and at the same moment moves the feeder partly towards the second scale, which then begins to be filled while the first scale is receiving slowly the finishing part of its load. When the loading of the first scale is complete, that scale falls through the remaining part of its descent, and, in falling, releases the catch that till then had held it in position, whereupon the loaded scale immediately tilts and simultaneously shifts the full stream of grain over to the second scale, and moves the register figure. The operation thus described proceeds from scale to scale, alternately, as long as the supply of grain is continued. The flow of grain is never cut off or interrupted during the discharge of the scales.

What makes this invention specially interesting is the ingenuity with which a very severe accuracy in the weight of each charge is secured without any consequent loss of time. In ordinary weighing, if great exactness is aimed at, the last additions are made slowly; and this, in fact, is always necessary, if one would avoid inevitable overcharge. Accordingly, as much time is spent in adding the last few grains or the last few ounces, as the case may be, as it had required to introduce the great bulk of the load previously. But by employing two balances, side by side, with a bridge, or doubly inclined shoot, between them, the inventors have made it possible to keep up a steady flow from the source, and still to finish off each load by so gently growing an increase that it is impossible an error should occur of any sensible amount; while, in the meantime, the nearly empty scale receives the main stream and rapidly fills.

This balance cannot fail to make its way among our Western farmers, and among the large class of our citizens who are engaged in the transportation of grain.

The engraving will be understood without requiring particular description. The parts important to note are the two scale pans, of which the one on the right is in the position to receive, and the one on the left in the position to discharge its load; the doubly inclined shoot or bridge extending across above the scales, and the supply shoot appearing above the whole. This supply shoot is sustained by a branched iron support, which is single at the base, and which forms a vertical axis, around which the supply shoot has the slight lateral movements, above described, which change the manner of delivery of the grain.

It is obvious that this balance is applicable to many purposes, in which accurate and continuous weighing is necessary, as well as to the weighing of grain.

HYDRAULIC CEMENTS—THEIR ADAPTABILITY FOR USEFUL AND ORNAMENTAL PURPOSES.

A Paper, read before the Polytechnic Association of the American Institute, by Adolph Ott.

PART II.

The Portland cement, as most artificial cements are now called, is at present manufactured, in England, Germany and France, on the most extensive scale. It forms a sharp, crystalline powder of a gray color, with a bluish or greenish tint. Chemically speaking, it is principally a silicate of lime and alumina, averaging 80 equivalents of silica, from 12 to 25 equivalents of alumina, and from 210 to 230 equivalents of lime. In being mixed with water to a stiff paste, it soon solidifies, forming a stone of a pleasing light gray color, which in its best quality acquires a hardness and durability, equal to the best limestones. Like the English Portland stone, the solidified Portland cement presents a crypto-crystalline texture; and, having no cleavage whatever, it yields evenly to the chisel. But this property can easily be dispensed with altogether, on account of the fact that, while soft, it can be adapted to any form.

You will pardon me for speaking of a composition stone of mine, of which I claim, all other conditions being alike, that it will continue to increase in solidity, while a stone merely composed of a mixture of hydraulic cement and sand (the latter being the common admixture) will have attained its greatest degree of firmness. Of equal quantities of my stone mortar and of Portland cement mortar, the former will bear a greater quantity of sand, without acquiring less solidity, that is, it will be of greater binding qualities. The *Journal of Applied Chemistry*, in a late number, says of this stone: "Judging from the appearance of the samples which we have seen, and from the several tests to which they were subjected, we would say that the felspar artificial stone (which is its name) is equal in solidity to the best building stones; while it is unquestionably superior to the artificial stones we have examined."

As regards the materials used, in addition to the main ingredients usually employed for the making of artificial stone, they are felspar or felspathic minerals (previously vitrified), quicklime and flint, in definite proportions. The chemical reactions taking place by this intermixture may be explained as follows: Hydrate of lime will, though slowly, replace the potash or soda in the felspar, and form a compound of the formula of Portland cement, of great binding qualities. This reaction is especially induced by the presence of flint, which, like several others of the chalcedonic varieties of quartz, (according to Fuchs), consists partly of soluble silica, which, having a strong affinity for the potash or soda set free from the felspar, will form a hydrosilicate of potash or soda. But, aside from the formation of silicate of lime and alumina (hydraulic cement), the final result of these reactions is an insoluble compound, probably of the formula of pectolite or acophyllite. Thus nothing remains that might be washed out; and again, through the formation of a cement (similar in composition to Portland cement) within the substance of the stone mortar, a slow but steady increase of the firmness of the stone is secured.

To speak more particularly of the application of hydraulic cements, they are especially useful for the manufacture of building stone. In Europe, especially in England, numerous buildings of the kind have been erected; in London, for instance, the celebrated College of Surgeons, in Lincoln's Inn Fields. In this country, buildings constructed of cement stone, made by the process of George A. Frear, have been erected in Brooklyn, Toledo, Buffalo, Chicago, and New Orleans. In the various cities of the West, upwards of three hundred buildings have been constructed of this stone during the last three years; and they have satisfactorily stood the test of the severe climate, which is more severe in the West than on the Atlantic coast. In Brooklyn, fifty-nine buildings are in process of erection at the present time. The novel feature in the process of Mr. Frear is, as we learn, a newly discovered solution of shellac, which is used in combination with the ordinary materials. The compound, when in the mold, is submitted to a pressure of thirty tuns to the square foot, which pressure, according to Professor Vander Weyde, is equivalent to placing a mountain mass of the same material 4,000 feet high on the top of the stone to be hardened. Concerning the solidity of this stone, it was found at the Washington Navy Yard to withstand 6,000 pounds, without breaking, on a cube of 1½ inches, which is 432 tuns per square foot. In regard to its deportment towards fire, we learn that the Frear stone stood the test of the great fire in Chicago better than any other building material in that city. Every stone left standing in the walls was found to be in perfect condition, and builders are now drawing away the blocks to be used in the re-erection of other structures.

Cement stones have also been largely employed for constructions in the sea, especially for harbor dams, breakwaters, and quay walling. We refer to the moles of Dover and Alderney, in England; of Port Vendre, Cette, La Ciotat, Marseilles and Cherbourg in France, of Algiers and Port Said in Africa, and to those of Cape Henlopen at the mouth of the Delaware. For the breakwater at Cherbourg (one of the most remarkable), artificial stone blocks of 712 cubic feet each were immersed. The harbor of Cherbourg being exposed to heavy gales, the largest blocks of natural stone which could be brought from the shore would be mere play balls of the waves. There are instances known where blocks of thirteen cubic yards were not only pushed far above the slopes, but also turned over at the head of the mole; hence the necessity of employing blocks of immense size. Such blocks can scarcely ever be obtained from quarries, to say nothing of the difficulty and expense of transporting them.

To speak of other uses of hydraulic mortar, I will mention that the beautiful fortifications before Copenhagen are wholly constructed of *béton* or concrete, an aggregate of gravel or broken stone, lime, and hydraulic mortar. Walling of *béton* for fortifications, according to competent artillerists, is far superior to any other work. This *béton* is more largely used for foundation walling, especially in water, for sluices, aqueducts, bridges, floors, sidewalks, terraces, roofs, cisterns, reservoirs, water pipes, etc. Entire buildings of two stories, with chimneys and cooking pla , have been constructed solely of *béton*.

The first sluice which was entirely built of concrete is the Francis Joseph sluice on the Danube, in Hungary. This work forms a reservoir, the bottom and the sides of which consist of one piece. Its length is 360 feet, and width, 30 feet. Its construction, begun in 1854, was completed within ninety days, the work being pushed forward both night and day.

Of unusual interest in the line of structures of *béton*, because demonstrating their great strength, is the monolithic test arch of St. Denis, near Paris. This arch forms, like the Francis Joseph sluice, one piece. The material used is known at the *béton aggloméré, système Coignet*, the last being the name of the inventor. The span of the arch is 196 feet, its elevation 19 feet, and length 49 feet. The stone possesses a fine texture, and is perfectly impervious to water.

M. Coignet's system of "monolithic construction" has also been applied for the erection of the aqueduct of La Vanne, which now carries pure water from the river of La Vanne in the department of the Aube and of the Yonne to the city of Paris. The distance from Paris to La Vanne is over 135 miles; and as there were hills, valleys, woods, rivers, etc. to be crossed, it is easy to understand that the construction of an aqueduct through that country required many fine works of engineering. The section which traverses the forest of Fontainebleau alone comprises three miles of arches, some of them as much as fifty feet in hight, and eleven miles of tunnels, nearly all constructed of the material excavated on the spot. So successful has M. Coignet been in his undertaking that other sections of the work, formerly intended to be built of masonry, of cast iron, and of boiler iron plates, have been allotted to him, to be made entirely of his *béton aggloméré*.

Hydraulic cement, instead of copper sheets, has been applied to cover the bottoms of ships. Railroad sleepers are being replaced by sleepers of cement. For ornamental work, (statues, fountains, etc), compositions of hydraulic cement have certainly a great future, since the most elaborate forms of art, of great durability and strength, may be most artistically and economically produced in them. For this purpose, only the very best qualities of cement can be used. By the admixture of proper colors, variously colored stones may be obtained. Although this industry, like everything new, had at first to struggle against suspicion and prejudices, it has gradually made its way by the excellence, beauty and durability of its products, and is now carried on in many places. In the Paris Exposition of 1867, there were statues of Socrates after Tabacchi, the bust of Raphael after Magni, and gothic church windows of immense size. Most in demand are, however, door and window caps, ashlars, stoops, window sills, door sills, chimney tops, bowls and tables for wash stands, etc. Artificial rocks, grottoes, inclosures for wells or springs, and cataracts for parks, gardens and hot-houses are also now being produced in cement. Parks which present not a single rock can thus be converted, within a few weeks, only into the most romantic and picturesque scenery.

Although it may seem that the application of hydraulic cements was exhausted, many new uses for it will doubtless be discovered. Scarcely any technical journal of importance reaches this side of the Atlantic without containing new information on this topic, and its literature amounts already to scores of volumes. In view of the paramount importance of artificial stone, is it not rather strange to see how little there is known concerning it in this country, while buildings of such stone have been erected in Europe for more than forty years? And with what feelings of surprise do we note the fact that the illustrious city fathers of this metropolis forbid the use of artificial stone as a building material, although its superiority over ordinary stone in point of economy, safety and health is a fact established beyond doubt! Might we not exclaim: "Science, forgive them, for they know not what they do?"

Influence of Medicines on Larvæ and Animalculæ in Standing Water.

Some time in August, having occasion to use rain water, I procured some from a barrel standing at the corner of the house. It had been standing there for a few days, and I at once observed that it was literally crowded with animal life. The mosquito *larvæ* and those of the gnat, and all the curious creeping, flying, swimming creatures that inhabit standing water during the summer, were revealed by a glass of moderate power.

It occurred to me to try medicines on the inhabitants of the teeming world, and watch the physiological effects. I poured into each of a row of goblets four fluid ounces of the water. To the first I added two grains of carbolic acid in solution. In five minutes every animal and animalcula was dead. Into the next glass I put one half grain of carbolic acid in solution. All were dead at the end of an hour.

Into the third glass were put two drops of chloroform. In two minutes every form of life was still, and on agitating the water the undissolved globules of chloroform caught up a large number of the dead forms, and rolled them up with itself. The minute forms of life, especially the microscopic ones, were all killed in less than a minute, when one drop of chloroform was added. Some of the larger forms remained at the top of the water, and did not seem to be affected with so small a quantity. Putting a gallon of water into a glass jar, I poured into it a drachm of chloroform, stirring the water with a spatula. Before the motion of the water had ceased, most of the lesser forms were dead, and were gathered into the globules of chloroform that were rolling at the bottom. Some of the larger *larvæ* lived for a little time at the top of the water, but soon afterwards they sunk to the bottom dead, and at the end of thirty minutes only one or two of the largest were alive, and no life could be discovered elsewhere with the naked eye, or by the magnifying glass.

Into another glass was put sulphuric ether, at first a few drops which seemed to have little effect; but when half a drachm was added, the larger forms died very soon, but the more minute lived for two hours. Into the next glass was put a drachm of Fowler's solution, liquid arsenite of potassa. At the end of an hour most of the smaller animalculæ were dead but the larger forms were alive at the end of two hours.

A solution of sulphate of morphia, five grains was put into another glass, and none seemed affected by it at the end of three hours. Into another was put a strong solution of common salt. The larger *larvæ* seemed affected by it in a short time, but many of the minute forms were alive at the end of three hours.

A solution of compound tincture of iodine, twenty drops, destroyed all appearances in three hours. A solution of soda sulphite destroyed the inhabitants of one glass in two hours. Ten drops of sulphuric acid seemed to have little effect on them. A large amount of alcohol only seemed to increase their activity. I repeated the experiment with chloroform several times, with the same uniform result. I did not have another opportunity to repeat the experiment during the fall.

The most remarkable effect was produced by the chloroform and carbolic acid. It suggested itself to me that, for certain purposes, water might be purified in small quantities with either of these substances. The addition of a small portion of chloroform would not injure water for many purposes; the chloroform would remain at the bottom of the vessel, and the rest might be filtered for use. The small amount of carbolic acid would not injure the water for many purposes, and it might be put into standing water to prevent its being populated. In any light the experiments were interesting, and I hope to repeat them on some future occasion.—*P. J. Farnsworth, M.D., in the Medical and Surgical Reporter.*

A DELAWARE correspondent proposes to anchor balloons, and let the world turn under them, by which means he expects to sit still and yet travel a thousand miles an hour. He does not state what he anchors to, but we suppose it is what Archimedes sighed for when he stated that he could move the world if he had a proper fulcrum. Perhaps the spirit of Archimedes inspired the ingenious inventor with this brilliant idea, and pointed out the fulcrum.

MINERAL WATERS.

Waters which contain unusually large quantities of any of the ordinary impurities, or which are characterized by unusual constituents, are known as mineral waters. Such waters may be valuable for their medicinal properties, or as sources of the special substances which they contain. As examples of medicinal waters, we have sulphur springs, which contain sulphuretted hydrogen; chalybeate springs, which contain iron, etc.; while brines and borax waters are valuable for the extraction of salt and borax.

SULPHUR WATERS.

Waters containing sulphuretted hydrogen gas are found in many parts of the world. Those of Harrogate, Croft, and Aix la Chapelle are renowned in Europe, while we have in the United States numerous examples, among which are the White, Red, and Salt Sulphur springs of Virginia, the White Sulphur springs of Ohio, and the Richfield, Sharon, Chittenango, and Florida springs of New York State.

The sulphuretted hydrogen gives these waters a sweet taste and a very peculiar odor, which some consider offensive. These waters have the property of blackening silver; persons who visited these springs in the earlier days of the republic, when specie was current, noticed a gradual darkening of their "change," which finally became quite black, owing to the formation of a black sulphide of silver.

SALINE WATERS.

The chlorides of sodium, calcium, and magnesium often occur in spring waters in such quantities as to cause a decided saline taste, agreeable in the case of the first mentioned salt, if not too intense, but bitter and disagreeable when caused by either of the others.

Sulphate of soda (Glauber salt) or of magnesia (Epsom salt) may also be the cause of a saline taste. Brines, which are important sources of national wealth in many countries, belong to the first mentioned class. Nearly all the salt manufactured in the United States is obtained from salt springs or wells.

You will realize their importance when I tell you that 9,000,000 bushels of salt have been manufactured in the neighborhood of Syracuse in a single season. The brine is here pumped up, through artesian wells, from a depth of 400 or 500 feet. It is undoubtedly derived from beds of rock salt, such beds having been already discovered in Canada, not very far distant. The famous St. Catherine's spring, in Canada, contains larger quantities of the chlorides of calcium and magnesium, which give its waters a bitter taste. The Kissinger bitter water illustrates the class of waters that owe their peculiar qualities to the sulphates of soda and magnesia.

ACIDULOUS SPRINGS.

Waters charged with such quantities of carbonic acid as to cause them to sparkle and effervesce as they flow from the spring, are called acidulous. Owing to the solvent power of this acid upon limestones and some other rocks, such waters generally hold considerable quantities of lime, magnesia and iron in solution, in the form of bicarbonates; when the latter is present in quantities of a grain or more to the gallon, the spring is called a chalybeate, from the name of an ancient people who worked in iron at an early day, the Chalybes. These waters often contain considerable quantities of chloride of sodium, and frequently bromide and iodide of sodium, as well as bicarbonates of soda and lithia.

Such is the character of the most celebrated mineral waters in this country, the well known springs of Saratoga and Ballston in this State. These waters are so well known to you that I will take the liberty of dwelling upon their peculiarities for a few moments. In the first place, I will call your attention to this section of the Saratoga valley, which shows you the position of the rocky strata there:

Beginning with the uppermost, the rocks of Saratoga county are: 1. The Hudson river and Utica shales and slates; 2. The Trenton limestone; 3. The calciferous sand rock, which is a silicious limestone; 4. The Potsdam sandstone; and, 5. The Laurentian formation, of gneiss and granite of unknown thickness. The northern half of the county is occupied by the elevated ranges of Laurentian rocks; flanking these occur the Potsdam, calciferous, and Trenton beds, which appear in succession in parallel bands through the central part of the county. These are covered in the southern half of the county by the Utica and Hudson river slates and shales. The most remarkable feature is, however, the break or vertical fissure which occurs in the Saratoga valley.

The mineral waters probably underlie the southern half of the entire county, many hundred feet below the surface, the accident of the fault determining their appearance as springs in the valley of Saratoga Springs, where, by virtue of the greater elevation of their distant source, they reach the surface through crevices in the rocks produced by the fracture.

Their common origin is also shown by analysis; all the springs contain the same constituents in essentially the same order of abundance; they differ in the degree of concentration merely. Those from the deepest strata are the most concentrated. The constituents to which the taste of the water and its most immediate medicinal effects are due, are: chloride of sodium, bicarbonate of lime, bicarbonate of magnesia, bicarbonate of soda, and free carbonic acid. Other important, though less speedily active, constituents are: bicarbonate of iron, bicarbonate of lithia, iodide of sodium, and bromide of sodium.

During the great petroleum excitement, a New York capitalist conceived the idea of finding oil at Ballston; so he selected a spot on the margin of the Kayaderosseras creek, a stream which flows through the village of Ballston into Saratoga lake. Here this patient but ill advised seeker after petroleum bored down through sand, clay, and hard pan, fifty-six feet, till he struck the solid rock. He tubed the well down to the rock with an iron tube six inches in diameter, and then continued the boring with a five inch drill. For a considerable distance the drill passed through the Hudson river shales; then it penetrated the Trenton limestone, then the calciferous sand rock, and probably passed some distance into the Potsdam sandstone. At a depth of 571 feet, a vein of mineral water burst into the well, but, as oil was the object of the search, it was not heeded. Finally, our zealous borer was spared further labor in this direction by the steel reamer, which became so firmly fastened in the rock, at the depth of 651 feet, that it could not be extricated. No oil making its appearance, and further progress in the well being out of the question, attention was directed to the mineral water, when it was found that the most remarkable water of the county had been discovered. While the strongest natural springs of the county contain from 600 to 800 grains of mineral matter per gallon, this water contained over 1,200 grains. It is so concentrated that it will actually bear dilution with an equal volume of Croton water, which is more than one can say of our city milk, though the experiment is often made by the milkmen.

Like the enterprise of sending warming pans to Cuba, this venture turned out an unexpected success. The well is now known as the "Ballston artesian lithia spring." Soon after, the "Franklin" and "Conde-Dentonian" wells were bored at Ballston, and more recently the "Geyser spouting well" at Saratoga. All these have been successful in bringing up very concentrated waters of the same chemical character as the natural springs. It is probable, therefore, that water can be obtained anywhere in the southern portions of the county by tapping the underlying Potsdam sandstone. In all of these wells, the water rises to and above the surface. Down in the rocky reservoir, the water is charged with gases under great pressure. As the water is forced to the surface, the pressure diminishes and a portion of gas escapes with effervescence. The wells deliver, therefore, enormous volumes of gas with the water, a perfect suds of water, carbonic acid, and carburetted hydrogen.—*Professor Charles F. Chandler.*

FRICTION GEARING VERSUS BELTS AND COG WHEELS.

Experiments in the use of friction gearing—that is, of pulleys transmitting power, by direct frictional contact between the smooth faces of the driving and the driven pulley instead of by means of belts or by cogs meshing into each other—have been very frequently made, and in many cases with remarkable success. So emphatic, are the recommendations of this method of gearing, given by men who have tried or witnessed its operation, that it is somewhat a matter of surprise that it has not been more generally adopted. It is claimed by many such persons to be equally well adapted to the propelling of gang, mulay or circular saws, mill burrs, or in fact almost any description of machinery, and to the transmission of any amount of power with the same or even greater useful effect than when belts or cog wheels are employed.

In the vicinity of Clinton, Iowa, some years ago, friction pulleys were introduced in a saw mill with such complete success in point of economy and convenience that they soon became an established institution throughout that entire region, superseding belts altogether, the latter being in some instances thrown out at heavy expense to give place to the new order of things.

The pulleys used in this case were built of soft and tough wood, strongly put together by their segments in such a manner as to present the least possible end grain of wood to the surface. They were placed on the main shaft, to which the power was applied by the engine crank or taken from the water wheel, as the case might be, in the ordinary manner. The faces of the pulleys were either parallel to the shaft or beveled at any angle required, according to the direction of the counter shafts to which the power was communicated. The segments of the pulleys were glued or painted together and their faces turned off perfectly true. It was found that they required about one third more width of face than would be necessary if belts were used. In one case, two gangs were run, each with a friction pulley three feet in diameter and having 24 inches face. For a mulay or rotary saw mill, a pulley of from 12 to 16 inches face was found sufficient. A friction pulley, ten inches in diameter with six inch face, was described as giving more useful effect and heating the boxes less than when the same pulley was used with a four inch belt. From the numerous experiments made, the conclusion was reached that a pulley of 20 inches face would successfully transmit 50 horse power without undue wearing or heating.

The special advantages claimed for this method were the saving of the expense of providing belts and loose pulleys and keeping them in repair. The mills were so arranged that each machine was run with its own counter shaft, geared either to the engine shaft or to one of the main counter shafts, so that each workman could control the operation of his own machine independently of the others, and with no throwing off or putting on belts. The pulleys on the counter shafts were of iron and very strong, each having the same face, of course, as the driving pulley, but being of any desired diameter, according to the motion to be obtained. By means of a movable bearing operated by a lever, the iron pulley was readily brought in contact with its driver, the motion necessary for this purpose being less than one eighth of an inch.

The statement that, for the proper working and durability of a friction pulley, it should be so made as to present as little end grain as possible to the surface, is emphatically disputed by experienced workmen, who claim that the precise opposite to this is the true method, and that the pulley should be so made as to offer the end grain to the contact of the other pulley to the utmost practicable extent.

To accomplish this purpose, the pulley is made of segments of wood cut out of a plank in the shape of a fan, the grain running parallel with one side of the fan, and the end grain being presented in a slightly oblique manner at the outer or circular edge. These segments are put together strongly, and so arranged that the grain shall not run in the same direction in two pieces in contact with each other, but cross in much the same manner as the furrows in the upper and under millstone. The object of this is to prevent the face of the pulley from too great tendency to wear in any given direction.

The rim of the wheel, as it may be called for convenience is built up by laying the first tier of segments, making a complete wheel of the thickness of the plank, flat upon the bench, and placing the other layers successively upon this, breaking joints and crossing the grain as already indicated. The layers are very strongly secured to each other with wrought nails, beside which glue or white lead is laid on between them. The rim being complete, mortises or gains are made to receive the pads of the spider at the end of the radial arms, these gains being somewhat larger than the pads, and the space thus given being filled by the insertion of keys, one on each side of the pad, entering from opposite directions and overlapping each other, the whole length of the pad. Bolts are also inserted, passing through the pad in a radial direction, with countersinking on the face of the pulley and a nut on the inner end. The countersink is afterward filled by plugging, over the head of the bolt.

The conflict of testimony in regard to the comparative efficiency of the pulleys in which the end grain is presented to the surface and those in which it runs lengthwise with the circumference is somewhat surprising, as the point is easily subjected to a practical test. Most mechanics will take ground without hesitation in favor of end grain, as less liable to yield and curl or "broom" up, when subjected to powerful and constant pressure.—*Leffel's Illustrated Mechanical News.*

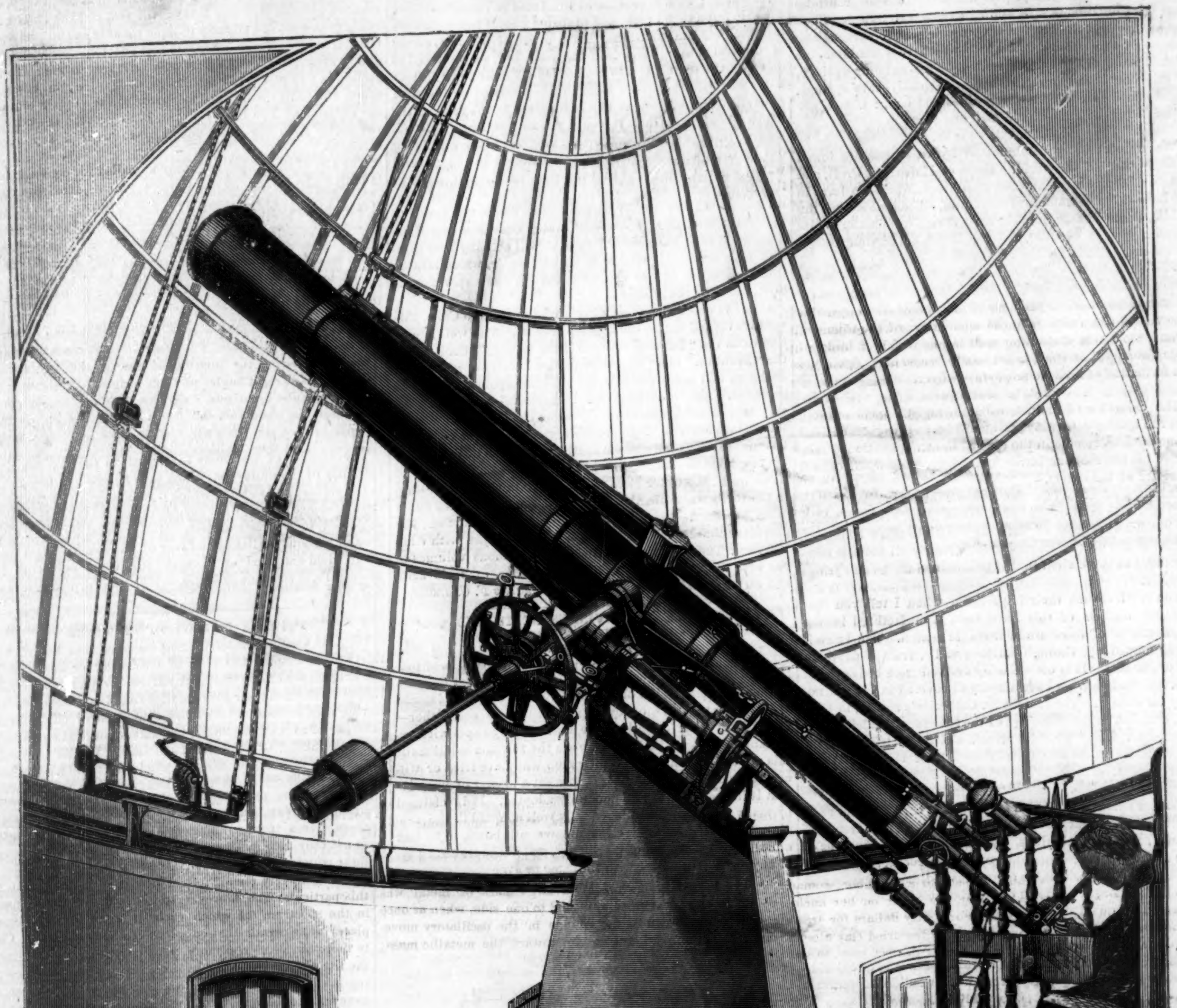
Painless Extraction of Teeth.

Dr. A. C. Castle (*Dental Cosmos*) observes that he has for thirty years adopted the plan of obtunding or benumbing the extremities of the temporal nerves, for painless extraction of teeth from their sockets, with complete success, never having used or countenanced the exhibition of chloroform, ether, or nitrous oxide gas for this minor surgical operation. The benumbing, or *mechanical anæsthesia*, of the temporal branches of nerves, obtunds the whole nerve to a sufficient extent to allow the teeth to be removed, with sensation so slight that, if not attending a special surgical operation, it would scarcely be noticed by the patient. One of two modes may be adopted. By application of ice to the temples, which is somewhat distressing, the sensation of cold striking deeply. The other, to which he gives the preference, is done by an assistant, with each of his middle fingers pressing with persistent firmness into the *fossa* or hollow behind the ridge or the temporal bone, which forms the external bone circle orbit of the eye. Pressure for one minute is all that is necessary. The practice is as simple as it is harmless, and leaves no after unpleasant sensation to annoy the patient. It is an instinctive method often adopted by people themselves, who press their temples with their fingers to relieve themselves temporarily of the acute paroxysms of nervous headache. This temporary pressure, with sufficient force, is all that is required to remove teeth painlessly.

Effects of Ice at St. Louis.

In consequence of the grounding of a field of heavy ice, covering over twenty-five hundred acres in extent, upon a bar in the Mississippi, at St. Louis, the current of the river has been thrown to the east side, and a new channel is cutting out which threatens to take in its way a large section of bottom land just below Brooklyn, and to carry away a portion of Bloody Island. Below an artificial promontory known as Long Dyke, extending fourteen hundred feet into the river from the Brooklyn landing, the current swings around almost at right angles with its former course, and has made a new channel, by cutting away lands of the Wiggins Ferry Company, with a deep, curving indenture to the east. For half or three quarters of a mile the current hugs the eastern bank, which at the last accounts was continually caving in. At one or two points, the river has worn its way within fifty or sixty feet of the Chicago and Alton Railroad track. The current does not leave the East St. Louis bank, except in cases of resistance by local obstructions, until it reaches a coal dyke opposite the foot of Chouteau avenue, where it resumes its old course. The result of this is that all that portion of St. Louis lying between the elevator and the new waterworks is now virtually without a practicable landing for the ordinary wants of commerce, except in case of very high water, with a prospect that, unless the current is turned back by artificial means, the lower part of the city may be in a similar predicament, in which case St. Louis would find itself on the wrong side of the Mississippi.

WORKING A TRAMWAY BY STEAM.—At Edinburgh a steam train has made a successful trial on the horse tramway just opened between Haymarket and Leith, a distance of several miles. The *Scotsman* says that, although it was the busiest hour of the day, and traffic was at its greatest, tramway cars with young horses fresh from the country constantly passing, no horse was frightened, nor were the bystanders annoyed by steam or smoke. The whole journey of a little over six miles was performed in fifty minutes, including all stoppages. The average speed maintained, exclusive of stoppages, was about nine miles an hour, and, it is said, might as safely and easily have been at the rate of twelve.



THE ALLEGHENY OBSERVATORY.—[See next page.]

Miscellaneous Health Notes.

The following health hints are from the November number of *Home and Health*, published by De Puy & Brother, 805 Broadway, N. Y. While the facts may not be new, to many of our readers they are worth treasuring:

EXPANDING THE LUNGS.—Step out into the purest air you can find, stand perfectly erect, with head and shoulders back, and then, fixing the lips as if you were going to whistle, draw the air through the lips into the lungs. When the chest is about half full, gradually raise the arms, keeping them extended with the palms of the hands down, as you suck in the air, so as to bring them over the head just as the lungs are quite full. Then drop the thumbs inward, and, after forcing the arms backward and the chest open, reverse the process by which you draw your breath, until the lungs are empty. This process should be repeated immediately after bathing, and several times during the day. It is impossible to describe, to one who has never tried it, the glorious sense of vigor which follows this exercise.

SLEEPLESSNESS.—The cure of sleeplessness is sometimes difficult, particularly in those who carry grave responsibilities. The habit of sleeping well is one which, if broken up for any length of time, is not easily recovered. Often a severe illness, treated by powerful drugs, so deranges the nervous system that sleep is never sweet after. Or perhaps long continued watchfulness produces the same effect; or hard study, or too little exercise of the muscular system, or tea and whisky drinking and tobacco using.

TO PURIFY THE BLOOD.—A well known physician says that he considers the following prescription for purifying the blood as the best he has ever used: One ounce yellow dock, one half ounce horseradish, one quart hard cider. Dose, one wine glassful four times a day.

A WORD ABOUT CIDER.—Alexander Frear, in the *Independent*, says: "For many bilious complaints, sour cider is a specific, and in such cases is one of the good things to be received with thanksgiving. Cider guzzlers are an abomination, but, if dyspeptics will take a little with their dinner, they will find digestion greatly aided. We go in for the manufacture of a good, pure article, and, in the use of it, to let our moderation be known to all men."

OAKUM AS A DRESSING FOR BURNS.—Mr. Robert L. Snow says of oakum, as a dressing for burns, that it induces the healing of extensive sores with remarkable rapidity; it induces healing action in those indolent ulcers that are the result of defective hygienic conditions; it prevents all smell; it is cheap, saves time and trouble; and, most important of all, the resulting scars do not contract.

THE EARTH CURE FOR ULCERS.—I dried and pulverized some clay, says a writer in *The Country Gentleman*, and recommended it as a valuable remedy to a neighbor woman who had for ten years had a very bad ulcer on her ancle. She had paid our best physicians over fifty dollars for treatment, without any relief. She applied the dried clay almost constantly for about six months, and a perfect cure has resulted. The first effect of the preparation was to remove inflammation and relieve pain, and now she says there is no scar remaining, and her limb, which was stiff and lame, is as elastic as when she was a girl. The woman is a very large, fleshy person, about forty years of age. I considered the test a very severe one, and the result very satisfactory. About a gallon of pulverized clay was used.

PAPER COMFORTABLES.—The mode of making comfortables warmer, by lining them with newspapers, is good as long as they last, which cannot be long, especially after washing a few times. I have tried a similar way of attaining the same object on cold nights, when I have not had sufficient bedding over me, especially at hotels, where we cannot always get just what we want. Throw off one or two of the top covers from the bed, then pull from the pocket or satchel two or three large newspapers—one very large one will do; spread them on the bed and replace the cover, and you will have a warm and comfortable night, without any perceptible increase in the weight of the bedding. Again, when you have a hard, cold ride in a cutter, of ten or twenty miles against the wind, place a spread newspaper over your chest before you button up your overcoat, and you will not become chilled through. Nothing can be cheaper, and, as far as it goes, nothing more efficient.

DARKNESS IN THE TREATMENT OF SMALL POX.—If a patient, in the beginning of the attack, be put in a room from which absolutely all light is excluded save that of a candle, the effect is to arrest the disease in the papular or vesicular stage; the skin between the vesicles is never inflamed nor swollen; the large scabs of matter never form over the face; there is no intense pain, and only trifling itching, and the smell is either very slight or altogether wanting.—*London Lancet.*

PERSONS afflicted with eruptive diseases should not use salt fish.

Cleanliness.

A neat, clean, fresh-aired, sweet, cheerful, well arranged house exerts a moral influence over its inmates, and makes the members of a family peaceable and considerate of each other's feelings and happiness. The connection is obvious between the state of mind thus produced and respect for others, and for those higher duties and obligations which no laws can enforce.

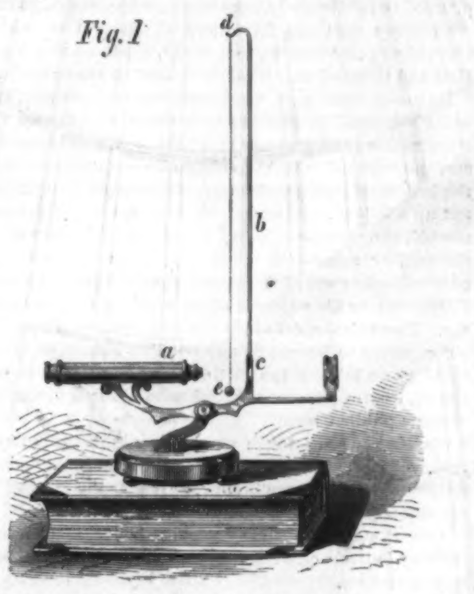
On the contrary, a filthy, squalid, noxious dwelling, in which none of the decencies of life are observed, contributes to make its inhabitants selfish, sensual, and regardless of the feelings of others; and the constant indulgence of such passions renders them reckless and brutal.

THE ATTRACTION OF THE MOON.

BY JOHN C. DRAPER, PROFESSOR OF CHEMISTRY, UNIVERSITY MEDICAL COLLEGE, NEW YORK.

Many ingenious methods for the measurement and illustration of the attraction of masses for each other have from time to time been described; it is therefore with a certain degree of hesitation that I offer a description of a method that I have of late employed in the illustration of this property of matter.

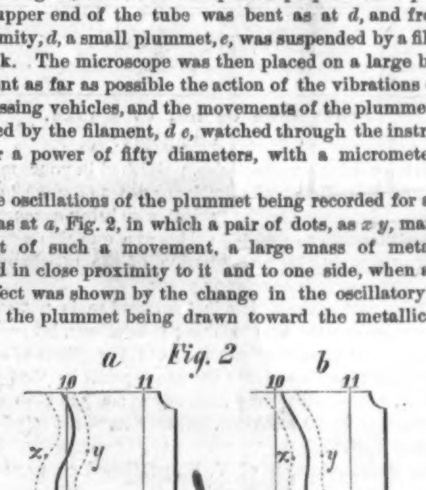
Fig. 1



A microscope being turned into the horizontal position as at *a*, Fig. 1, a glass tube, *b*, 20 inches in length, was attached to the stage *c*, so that it occupied a perpendicular position. The upper end of the tube was bent as at *d*, and from the extremity, *d*, a small plummet, *e*, was suspended by a filament of silk. The microscope was then placed on a large book to prevent as far as possible the action of the vibrations caused by passing vehicles, and the movements of the plummet, as indicated by the filament, *d e*, watched through the instrument under a power of fifty diameters, with a micrometer eyepiece.

The oscillations of the plummet being recorded for a short time as at *a*, Fig. 2, in which a pair of dots, as *x y*, mark the extent of such a movement, a large mass of metal was placed in close proximity to it and to one side, when at once its effect was shown by the change in the oscillatory movement, the plummet being drawn toward the metallic mass;

a Fig. 2 *b*



the filament no longer moved over the distances bisected by the curved line, *a*, which nearly corresponds to the line or division 10 on the scale, but followed the record shown at *b*, in which the curved line, *b*, occupies a position intermediate between the divisions 10 and 11 of the scale.

The delicacy of this method of investigating such attractions may be greatly increased both by an increase in the magnifying power used and by an increase in the length of the suspensory filament, and, if employed in localities where there is less vibration caused by the unceasing passage of vehicles than in New York, might be so developed as even to show and measure the variation in the attraction exerted by the moon, as she changes her position in regard to any given locality on the earth's surface.

PENDULUM EXPERIMENTS FOR DETERMINING THE GRAVITY OF THE EARTH are about to be made in the Mont Cenis Tunnel by Father Secchi, M. Diamiller-Müller, and M. R. P. Denza. These will be made first in a lateral chamber about the center of the tunnel, and will be afterwards repeated at the corresponding vertical point on the mountain, the difference of level being about 1,600 metres. In addition to these observations, they propose to determine the earth's magnetism and the temperature of the strata to which they can obtain access. By preliminary observations, they have ascertained that the movement of the trains will not, to any serious extent, interfere with the precision of the observations. Telegraphic wires will be laid down for the purpose of chronographic registration, and the observing chamber will be ventilated by special air conduits.—*Comptes Rendus*, Vol. LXXIII. p. 1,192.

THE ALLEGHENY OBSERVATORY.

Our engraving is a view of the interior of the dome of the Allegheny observatory, at Allegheny, Pa., for which we are indebted to our excellent cotemporary, the *People's Monthly*, published by McKnight, Lowry & Co., Pittsburgh, Pa. In the center of the dome, and supported by a massive pier of stone, is the equatorial telescope. The optical part of this instrument was made by the late Henry Fitz, of New York, who also furnished the equatorial for the Dudley observatory at Albany, of which telescope this is a duplicate. The object glass is 13 inches in aperture, or rather more than an inch larger than that of the great refractor, placed by Mitchell in the Cincinnati observatory, and so well known from his popular lectures. Like all large instruments of its class, the telescope revolves about an axis, inclined so that its motion around it may be parallel to the equator, and it can be caused to follow the stars as they move in the sky. This is effected by clockwork of peculiar character attached to the other side of the pier, but temporarily dismounted for repair, and not here shown.

The figure of a person seated in the observing chair will give an idea of the size. The observer is represented as using the spectroscope, the instrument nearest the eye, the rays being bent at right angles to their original direction in the telescope tube by prisms. On the table and nearest to the pier are the induction coil (built by Rhumkorff, of Paris) and a Leyden jar, from which wires pass up to the spectroscope, while others connect the coil with a galvanic battery in a lower room.

If the large telescope be directed, for instance, to the sun, its rays are first concentrated by the object glass of the telescope upon a very narrow slit within the spectroscope, through which they pass to the prisms, which are of flint glass of especial purity, and by which they are spread out into the beautiful solar spectrum, with which all are more or less familiar. The spectrum in this instrument is observed to be filled with thousands of narrow black lines, which are known to be caused by incandescent metals in the sun.

Whatever the distance of an object, its light, when thus analyzed, gives certain indications of the nature of the substance emitting it. Thus, if the telescope be directed to the chimney of any glass works in Pittsburgh, the soda, there employed, will cause the flame from the chimney to indicate the presence of sodium, and if the sodium be as far off as the sun, the evidence of its existence is no less certain. To illustrate the use of the induction coil, as it is shown in our engraving, we may suppose the observer to note certain lines in the sun, which he suspects are due to iron existing there. Iron, if it is subjected to such an enormous heat as to not only melt but turn it into vapor, is known to give light which shows several lines, but so do gold, copper, tin, and in fact every metal. It is necessary to know that it is this particular line, however, and no other of the thousands in the spectrum (of which each, it is noted, has its own place) to be certain that only iron can have caused it. Clearly there can be no test more conclusive than to examine, at the same time and with the same instrument, the lines coming from the sun and from iron heated for the purpose, and to verify by such actual trial their exact coincidence of position.

To do this, two particles of iron are fixed at the end of the wires which pass from the coil to the spectroscope, besides a little mirror which will reflect their light in, together with the sun's, but just above it. Now, when a galvanic current has traversed the coil, it is caused to leap across from one bit of iron to the other, tearing off minute particles of the metal as it crosses, and generating a heat so intense as to turn them instantly to brilliant vapor, whose light is found to contain the lines in question, each line—for there are several—*exactly* over the corresponding one in the sun.

The observer's hand is represented as grasping the micrometer, an instrument attached to the spectroscope, by which the position of the lines is determined to the ten-thousandth part of an inch. It is with such minute precision that the absolutely perfect coincidences of these lines are verified, one set coming from a source within arm's length, the other from across ninety million miles of space.

On the left of the table is another micrometer, used chiefly for such purposes as measuring the positions of the double stars, the diameters of the planets, the hight of lunar mountains, and generally, for all celestial measurements of very small distances. The apparatus on the right is the solar eye piece, one of the latest improvements in its kind, and capable of diminishing the light and heat of the sun indefinitely, without the use of darkening glasses. Its light may be thus enfeebled till it is fainter than moonlight, while every part remains distinct. When the telescope is turned toward the sun, and its rays suitably condensed by the great lens at one extremity and smaller ones at the other, the heat is sufficient to melt iron, and a jet of flame bursts as suddenly from a piece of hard wood passed before it as though it were struck by lightning. It is into this very focus, of otherwise intolerable light and heat, that the polarizing eye-piece enables the observer to place his eye without more pain from gazing on the sun than from gazing on a newspaper.

Beyond the pier is the reflecting galvanometer, used, among other purposes, for investigating the heat from the sun or stars when their rays are directed by the telescope into the thermopile beside it.

The spectroscope can be removed and its place supplied by the micrometer, or by various eye-pieces which vary the magnifying power of the telescope from sixty to twelve hundred times; and the whole instrument, which weighs some thousands of pounds, is so poised that it can be directed by the pressure of a finger to any quarter; while the dome revolves above it by separate machinery.

In the western wing of the observatory is the transit instrument, built for it by Troughton & Simms, of London, in 1868. It rests on piers formed of single blocks of stone, which repose on foundations built up from the bed rock of the hill. As stable as it is possible to make its supports, the power of such an instrument is so great that the almost inconceivably slight jar induced in one of the great masses on which it rests, by a tap of the fingers, is magnified sufficiently to cause a tremor, through these tons of stone, which is visible when it is directed to a star. To prevent the footsteps of any person moving near it, therefore, from causing a displacement, which, though otherwise quite invisible, would impair the accuracy of its observations, the floor is built so as not to touch the supporting piers.

Every portion of its construction demands the highest class of skilled labor. The axles of such an instrument are required to be as nearly as possible mathematical cylinders of equal size, and are ordinarily turned with a diamond; and a corresponding care is employed in the finish of all its parts. The sidereal clock was built for the observatory by Frodsham, of London, and the mean time clock by Howard, of Boston, whose work does not suffer by the comparison. A chronometer by Frodsham and other instruments are also supplied.

Time from these clocks is now distributed by electricity through Pittsburgh and through nearly all the railroad system of Pennsylvania.

A part of the work done in observatories consists of measurements of extreme accuracy of the positions of the heavenly bodies by means of clocks of unusual exactness, not differing in principle from good "regulators," such as our watchmakers keep for reference, but of a more thorough finish, and proportionally exact performance. The measurements are made by these, together with the transit instrument just described, in whose focus is a series of lines formed by stretching at regular distances threads of the finest cobwebs, and which are illuminated artificially at night; so that when the instrument is directed to the heavens, they appear like black lines drawn over the bright background of the sky, and across which the stars are seen to pass. As the motion of the earth carries these threads steadily and swiftly by from star to star, the *time*, that elapses from the crossing of one of them by the thread to its passage over another, may evidently be made to measure their apparent *distance*, and for such measurements observatories engaged in star investigations will evidently need time of the greatest exactness for their own purposes, quite independently of any wants outside. It is not the least of the practical uses of an observatory that this time can now be applied by electricity to the convenience of the community in regulating public and private clocks, and enhance the public safety by communicating unity and exactness to those of our railways.

The precision, with which such instruments as these described are employed for the purely scientific demands of modern astronomy, is surprising. "Exact to the very second" would be considered as expressing the highest possible accuracy outside of an observatory; but there an error of a far smaller amount in the place of a star would be considered as a gross one. The probable error of the position of the stars measured by clocks in the way already indicated, is, as a matter of fact, within such a limit, and does not in some cases exceed one one-hundredth part of a second of time. Such minute intervals are really as non-existent to all ordinary use as the infinitesimal motions we have spoken of above are to our unaided senses; and many will be disposed to question not only the utility of such minuteness, but its possibility. But not to stop to explain the utility, the possibility can at once be demonstrated: If we follow certain wires which lead from the clocks to the other extremity of the building, we shall find there, among other instruments which we pass without description, one—the chronograph—where each swing of the pendulum is caused to write itself down through electricity, which, with every beat, pulsates along the wire and moves a recording pen above a sheet of paper travelling under it with absolute uniformity, by peculiar and beautiful mechanism. Here the time is measured by the foot like a ribbon, and the space corresponding to the hundredth of a second made visible.

From the mean time clock, go other wires, which pass outside the building to the telegraph connecting it with various points in Pittsburgh and Allegheny, and thence to the stations of the Pennsylvania Central and other roads.

At Altoona, Harrisburg, Philadelphia, Erie and other important stations, are little silvered bells through which the wires pass and are made to connect with the tongue, so as to cause it to ring with a single stroke when the electric current is interrupted at any part of the long circuit of wire which stretches all over the State.

We cannot give an exact explanation which would be clear to any but an electrician, but the general reader will get a good idea of what we want to describe by supposing himself to follow these wires from any distant city up to their end in the clock at the Allegheny observatory. Here they terminate in small plates of gold. These rest in light contact, and will be separated by the slightest motion of a jewel with which they are connected.

This jewel is struck every second by the tooth of a wheel, which, by moving it, pushes apart for an instant the gold points, and interrupts the current. At the instant the current is broken here, it ceases to pass through the distant bells, and so is broken and renewed every second in the day and night at points stretched over more than a thousand miles of road. At certain hours of the day the railroad telegraphs suspend other business to allow the observatory clock to be thus heard, ticking as it were in the furthest corner of the State. Of course every station gets *identically* the same second of time, the hour and minute being distinguished by a simple contrivance.

This system was arranged by Professor Langley, the director of the observatory, after personal examination of those used in Europe; and it somewhat differs from any employed there, chiefly in the direction of a greater simplicity in its details. It is believed to be already (with the exception perhaps of that from Greenwich) the most extended system of control from any observatory *in the world*, and it is apparently only beginning to be used as it will be hereafter.

When it is adopted by the Western roads, there will be *one time* on them from the Atlantic to the Mississippi, in place of the different systems which cause a change of time with every road one rides over. That will be *Pittsburgh* time, if the city sees fit to put the clock on the New City Hall and those of the fire alarm into this great circuit.

Its use at Pittsburgh began some two years ago, in 1869, when Messrs. J. B. McFadden & Co., a well known firm of watchmakers and jewelers in Pittsburgh, applied to the observatory to enable them to obtain by electricity its time for the benefit of their customers, proposing for this purpose to put up a line of telegraph. Such a line was subsequently erected, and for the general benefit of the community, the observatory undertook to supply, upon payment of the proportionate costs incurred, any watchmaker or jeweler in Pittsburgh or the adjacent cities with the time in this manner. The actual costs of the observatory in this matter were not expected to be met by any possible return, it being enabled to do this by the gift, of the special instruments required, from a generous friend who desired to enable it to confer a public benefit.

Observations are taken every fair night throughout the year, with the exception of the Sabbaths, and every pains that interested attention can bestow, to render the system as useful as it is general, is given.

A great many beautiful accessory instruments have been recently built to order for the observatory, by the best European makers.

An honorable exception is to be made in favor of the time distributing apparatus, which was supplied chiefly by Messrs. E. Howard & Co., of Boston.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

To Smoke or not to Smoke.

To the Editor of the Scientific American:

Having read the two articles, published in your most valuable paper, entitled "To Smoke or not to Smoke," and being much interested in the subject, also being encouraged by your willingness to give both sides of a question a fair hearing, I submit this in corroboration of the article published page 375, last volume of your paper.

If the proof in the article just referred to is not sufficient to convince any one that smoking is injurious, let such a person ask, of as many smokers as he can, the effects of smoking upon them; and invariably the answer will be that it hurts them and they wish they had never smoked (the concluding sentence of all smokers), but they have not mind enough to leave it off.

The communication of V. B., published on page 388, in which he would prove smoking to be beneficial rather than detrimental, is ingenious, but, in my estimation, proves but very little in favor of smoking. Now a practical test, in this matter as in all others, is better than the supposition of V. B. that tobacco may be beneficial to man, although it kills a rabbit, because some other poisons fatten animals of one species and kill those of another.

I am a young man who has smoked for several years, and I wish to make known its effects upon me. It has injured my eyesight, and also my memory; and at one time, my nervous system was nearly prostrated. I left off the habit (by the advice of a physician), for several months, and I rapidly gained until I felt quite well. My eyes did not trouble me as before and my weight was much more than ever before; but my appetite was so strong for it, that, no sooner than I found myself well, I again took up the habit, and I gradually fell away in flesh; my eyes began to trouble me again, and my nerves began to shake. I again left it off, and, as before, I gained rapidly. When I saw the communication of V. B., I thought I would give it another trial, the result being the same as previously obtained.

V. B's. article tends to encourage young men in the practice of this habit, and it is to and for the young men that I write. My love for it was such that I have tried every means to prove to myself that it was not injurious to me, and so I caught at the ideas of V. B., taking more rest as advised by him. And the evidence of nearly all the smokers of my acquaintance is substantially the same as here stated. One thing more in reference to V. B. I think his comparison of the practical application of the weed out of place; we cannot arrive at anything definite by comparing two different nations in different countries. There are other reasons more potent to be ascribed for one nation being so much in advance of another. The Germans might be even more powerful than now without the use of tobacco, and the Chinese, in a still worse state; so the test applied to different nations proves nothing. Granted that it was not injurious, it is still useless and expensive, and had better be discouraged in young men than encouraged. V. B. expressed a wish to hear what the laymen say; in this letter he has the evidence of one. I hope you will not reject the evidence of a young man, in case of so much importance to the interests of young men.

E. F. S.

Cheap Method for Oxygen.

To the Editor of the Scientific American:

I think those interested in the production of cheap oxygen will find the following process of obtaining it cheaper than any other heretofore applied means for obtaining it in large quantities, except the German method of getting it by compressing air over water until the latter absorbs the oxygen thereof and drawing it out by means of suction or a vacuum, this being too slow and requiring too cumbersome apparatus for industrial use.

It is well known that certain substances like charcoal, oil of turpentine, etc., have a property of absorbing large quantities of ozone from the atmosphere; (this accounts for the bleaching action of bone black in refining sugars.) My idea is to force the air that has been ozonized by artificial means into a chamber or vessel filled with some such absorbent, giving the air so forced sufficient compression to cause the ozone to penetrate the mass of the absorbent, and, after the absorbing material is sufficiently saturated therewith, to draw it out by an exhaust apparatus, pass it through some caustic alkali, like caustic potash, to remove the remaining nitrogen, as nitrogen in presence of ozone will combine with such alkalies and form nitrates; the remaining ozone is then heated to a sufficient temperature to reconvert it into oxygen, and the process is through; the only thing remaining is to collect it in a receiver.

Naphtha exposed to ozone under pressure will become oxidised to such a density that it can be made perfectly safe for burning in lamps, even safer than the adulterated kerosene sold in the shops.

New York city. C. F. DUNDERDALE.

Remarkable Explosion.

To the Editor of the Scientific American:

On the 22d Dec., while employed in making tools in the establishment of Mr. Perkins, in Norwalk, Ohio, I met with an accident of so singular a character as to excite the most lively curiosity as to its cause.

I was about to temper a common reamer or rimer, by plunging it into sulphuric acid. The moment the heated steel came in contact with the acid, an explosion took place, throwing the acid in all directions, accompanied by a report equal to that made by a well loaded shot gun. The acid was thrown against the ceiling, about sixteen feet high, and over my clothing, face, and left arm, causing very painful sores, and threatening me with a loss of eyesight. The vessel containing the acid was a wide mouthed crockery jar, and there was about two gallons in it at the time. The jar was not broken, but the reamer was blown away from me, and was found much sprung, or twisted. I have used this acid very frequently, and have seen many others use it for tempering purposes; but this is the first instance, that I have ever heard of, of an explosion occurring. Indeed, the same lot of acid was afterwards used for tempering, without any indication of a blow up.

I send you this imperfect description of the occurrence, hoping that some of your correspondents will explain the mystery. So many persons are using this acid for tempering steel, that any danger attending its use should be pointed out and understood. The lucky escape I had, from being made blind for life, prompts me to ask you to call attention to this point in your widely circulated and eagerly read columns.

Norwalk, Ohio. GEORGE A. STANBERY.

[We think a possible cause for the explosion may have been the generation of hydrogen during the oxidization of some metallic fragments, introduced into the tempering pot through accident or design. This gas, mixed in the proper proportions with the air above the acid, would form a violently explosive mixture.—EDS.]

Photo-Mechanical Printing Process.

Captain Waterhouse, Assistant Surveyor General of India, describes in the *Photographic News*, Vol. XV. p. 556, a very simple method, of printing with ordinary printing ink from gelatin plates, that he has recently invented. He dissolves one ounce of gelatin in six ounces of hot water; then dissolves ten grains of tannin and thirty grains of soap, each in one ounce of water; mixes the two together, and adds them to the hot gelatin solution, very gradually, stirring all the time. The whole solution is then filtered through a coarse cloth into a jug, and, while still hot, is poured over the glass plates to be used. When the film of gelatin is quite set, the plates are turned upside down to dry. They are sensitized by being left for five minutes in a bath consisting of one ounce bichromate of potassa to twenty ounces of water. When dry, they are ready to be placed under a reversed negative. The time of exposure varies, from five minutes for clear line subjects to half an hour, or even longer if the negatives are very intense. Experience alone can decide. The back of the plate is next exposed to the sun for a few minutes to harden the gelatin, and it is then put in a dish of clear water, and washed till the whole of the bichromate is removed. The water is wiped off, and the plate is at once ready for printing from. After the plate is inked in, the superfluous ink is removed with a damp cloth, the paper is laid on, and pulled through the press in the ordinary way.

MR. WILLIAM SANDERSON, C.E., is engaged at present in making experiments with the object of trying how far it would be possible to utilise water power on the Himalaya Mountains in connection with the light mountain tramways.

THERE is no rule of health more important than "keep the feet dry and warm, and the head cool." An old story, but worthy of being often repeated.

[For the Scientific American.]

THE MODERN THEORY OF HEAT APPLIED TO THE PHENOMENA OF LATENT HEAT, COMBUSTION, ETC.

BY P. H. VANDER WEYDE.

If we accept the hypothesis, now raised into a theory, that heat is nothing but a peculiar mode of motion of the molecules of ponderable matter, it becomes much easier than ever before to correlate, under a single principle, the different phenomena presented in the effects of heat. In the first place, then, as all bodies possess a certain temperature, and we have not yet been able to cool any substance to the absolute zero point (which is very probably 460° below the zero of Fahrenheit), we must conclude, therefore, that the molecules of all solid bodies are in a condition of oscillation around their own centers or around a point in their vicinity; that, by rise of temperature (more motion), the amplitude of this oscillation increases; and, by a descent of temperature, (decrease of motion), the amplitude decreases; and as oscillations of greater amplitude require more space than those of a less amplitude, it is clear that bodies when heated must occupy more space, must expand.

These oscillations take place in simple bodies around a point situated between or near the single, double, or triple atom, in proportion to their allotropic condition; but, in compound bodies, the compound molecules oscillate; after the chemical decomposition of a compound body, the oscillations of the compound molecules are changed into the separate oscillations of the constituent atoms.

When the temperature is raised to a certain point, which differs for each substance, the amplitude of the oscillations becomes such that it reaches half or perhaps rather a whole revolution; and the oscillatory to and fro motion changes into rotation, and the substance becomes liquid or melts. We must, therefore, conclude that in water the compound molecule of H_2O is in a continuous rotation, at a velocity between that of the electric and luminous waves; and that, when water congeals, this rotary velocity is lost and changed into an oscillation, the remnant of the rotation, in the same way as a short pendulum will behave when, after rotating a while around its point of suspension, it is left to itself and to gravitation. This force of rotation, being abandoned by the congealing body, is communicated to the molecules of the surrounding bodies, and, increasing the amplitude of their oscillations or the eccentricity of their rotation, constitutes that which we mean when we say that latent heat is set free.

When substances crystallize during congelation, it proves that their molecules or atoms have poles, giving them definite positions in regard to each other, in which positions they continue their oscillations, as long as they possess a trace of that force which we call heat, and which, of course, like all motion or force, is as indestructible as is matter.

Notwithstanding this oscillatory motion, the molecules or atoms of solids are kept together by a polar attraction, overreaching the space occupied by the oscillations; this is the cohesion of bodies, and is, for the greater portion, lost when the oscillation is changed into rotation, that is, when the body melts. Then the poles are so intermingled that no polarity manifests itself, except in peculiar circumstances; for instance, the transmission of polarized light and its application to the saccharometer gives a proof that, even in the fluid condition, this polarity of the molecules is not always destroyed.

In order to explain the expansion of water during congelation, we have only to accept the hypothesis that the center of oscillation of the ice molecule is further removed, from the center of the molecule itself, than the center of rotation of the water molecule; it is then evident that the oscillation of the ice molecule must require more space than the rotation of the water molecule.

When now we heat the liquid obtained, that is, increase the velocity and consequently the eccentricity of the revolving molecule, these motions will occupy more space, and the liquid will expand. In the case of water, however, it appears that, at 40° Fahr., the center of rotation is the nearest to the center of the molecule itself, as the rotation occupies less space at that temperature, proved by the fact that the water then possesses its greatest density; below that temperature, there is a slight eccentricity at one side of the center of the compound molecule; by the rise of temperature, this point is driven through the center to the other side, where, at 47° Fahr., it is as far beyond the center as at 32° on the other side; with increasing temperature, the distance, of the center of the molecule from the center around which it rotates, increases continually, and its small remnant of the originally strong cohesive force of ice is soon destroyed when not kept together by pressure, ordinarily the atmospheric pressure; when, however, the point is reached where this pressure is not able to assist the feeble cohesion of the liquid to maintain itself in its liquid state, it is lost, and the liquid becomes a vapor; that is, applying the language of the modern theory of heat: when the velocity of molecular rotation and consequent eccentricity of this motion become so great as to overcome internal cohesion and external pressure, the molecules will fly off in very elongated ellipses or nearly straight lines, strike the walls of the vessels confining them, and cause what we call the pressure of steam or of vapors in general. It is thus the impact of the molecules which is the cause of what we call steam pressure; they make up for their infinitesimal small weight by their enormous velocity. As the result of impact increases in the ratio of the square of the velocity, it becomes at the same time clear why the pressure of steam increases in a much more rapid rate than does the temperature by which it is generated.

When we succeed in changing all the force of this molecular impact into motion of masses, we have the perfect steam engine; in all steam engines, however, this force is to a great extent communicated as molecular motion to surrounding bodies; that is, in common language, a great deal of the heat of the steam is lost by conduction and radiation; and this can, by our present system, not be entirely avoided. In the meantime, one of the best tests for the value of a steam engine is the determination of this heat, carried off by the water of condensation, which years ago was carried out in a crude way by experienced engineers, who dipped their hands in the hot well of the engine, to ascertain if it worked satisfactorily. This method has recently been perfected by Farey and Donkin in London, who measure the amount of condensation water carried off and its temperature, determine the number of heat units lost, and even have the same recorded by photographic and mechanical means.

The heat, made latent in volatilization or set free by condensation, is, therefore, in the language of the new theory, nothing but the motion stored up in changing molecular rotary into molecular rectilinear motion, or the motion given out again by the reverse operation.

When raising the temperature still higher, that is, increasing the velocity and amplitude of these molecular rectilinear or very elongated elliptical motions or vibrations to the degree of 400,000,000,000,000 in a second, the body becomes luminous, red hot, whatever be its nature; this corresponds with a temperature of about 1,000° Fahr., and is equal in velocity to the vibration of the caloric ray at the extreme visible red end of the solar spectrum; when we raise the temperature still higher, we add vibrations of greater velocity, which finally correspond to those of the blue and violet or chemical rays of the spectrum, which have the capacity of decomposing certain substances, and are the rays to which we are indebted for the possibility of the photographic art; in which, however, the activity of these rays may be, and commonly is, used without the help of heat. In the rise of temperature to the point of dissociation, however, we have vibrations of these velocities, and of all lower velocities, that is, all lower degrees of heat, combined with the higher; and when the dissociation, that is, the decomposition by intense heat, takes place, the vibratory motion of the combined atoms HOH of steam is changed into the separate motion of two atoms of hydrogen and one of oxygen, and each sets up for itself; this consumes so much molecular force that 3,000 units of heat are made latent; and it is this latent heat or molecular motion, stored up in the uncombined hydrogen and oxygen gases, set free by their mutual combination or combustion, which is the source of the enormous heat produced by this process.

We may then compare the heat, successively produced by the processes of combustion, condensation, and solidification of H_2O, as the fall from so many precipices, each similar to the evolution of heat produced by the descent of a certain number of foot pounds. The first fall is that of each oxygen atom in the embrace of two hydrogen atoms, setting free 8.000 units of latent heat, we now have steam of 5,072°; by allowing its temperature to descend, we reach a second precipice at 212° Fahr., where the rapidly moving vapor molecules will fall together to one 1,700th part of their former volume, and form a liquid, setting free 962 units of latent heat; causing the temperature of this liquid to descend; or, in other words, decreasing the velocity of the rotation of its molecules, we reach another point, where the force is not sufficient to carry each molecule over its center of rotation, and an oscillation, with the poles of each atom in a definite mean direction, remains, evolving another amount of latent heat of 142 units.

I have thus traced the conversion of solid ice into gaseous oxygen and hydrogen, and back again into solid ice, by accepting the beautiful and simple theory of heat as a mode of molecular motion; if, in the view of some, the existence of these motions appears improbable, or merely fanciful, by reason of the smallness of their extent and their extreme rapidity, I point only to the extreme smallness and rapidity of the luminous waves, and the infinite smallness of the atoms of matter, which are facts proved beyond the possibility of contradiction.

[For the Scientific American.]

EXPOSE OF THE TRICKS OF THE DAVENPORT BROTHERS.

BY P. H. VANDER WEYDE.

Two reasons induce me to listen at once to the appeal made on page 340, last volume, to explain the wonderful (?) performances of the Davenports; one is, that any tardiness in my reply might perhaps cause some one to doubt if I really had done all that the Davenports did; and the other is, that it will give me an opportunity to illustrate forcibly how necessary it is to see such kind of performances personally, if we wish to explain them; and how by hearing a mere account from those who have seen them, the most important parts, giving the key to the whole, are lost. All the surrounding circumstances, even the merest trifles, must be considered if we will rationally explain it, without taking recourse to the method by which the savage imagines he explains every phenomenon of nature which excites his amazement. The Indian accepts a Spirit of the thunder and lightning, a Spirit of the winds, a Spirit of every waterfall, etc.; in fact, this belief in spiritual interference in the affairs of our material world is nothing but a remnant of barbarism, which must be rooted out if we would lay claim to be called an enlightened people in this nineteenth century.

The main apparatus used by the Davenport brothers is a wardrobe or cabinet, with three doors, all locking with bolts on the inside. It is six feet high, three feet deep, and some seven or eight feet long. A wooden seat or bench occupies the whole of the back and sides, while the performers occupy the side seats, so that they cannot be seen by the audience when the middle door alone is opened. When each is tied up by one of the audience, the assistant or manager closes the side doors and slides the inside bolt in place, by passing the hand through the open middle door; he then pushes the middle door, when the bolt on this is immediately closed by the persons inside, notwithstanding their hands and feet are tied; they do this of course with their mouths, in reach of which this bolt is situated.

Before closing the doors, he places a speaking trumpet on the middle seat, also within reach of the mouths of the performers inside, when this, immediately after the closing of the middle door, is thrown out through a small window, situated in its upper portion; the box is placed a little forward, so that the middle door, as soon as the bolt from its inside is withdrawn, falls open of itself; this happens immediately after the throwing out of the speaking trumpet; then the manager steps forward, withdraws the bolts from the inside of the two side doors, opens them, and exposes the brothers to the full view of the audience, when, of course, they are seen tied up, head and feet, as they were a moment before; of course they have not used their hands, but one of them did throw out the trumpet with his mouth, by taking hold of the mouthpiece with his teeth, lifting it up till the other end reaches the little window, thrusting it through, and letting go, the other end being heavier it of course tumbles outside. When this trick is appreciated by the audience it is repeated a few times, and then other performances are proceeded with.

Before describing these, I cannot omit to mention an incident proving the obtuseness of the public. On the first occasion when I saw them perform, I had the distinguished honor (?) of being selected by the audience to go on the platform and tie one of them up, to guard the audience against deception, and testify afterward that no deception was used. I saw at once that, in the performance of this trick, the mouth had been used in place of the hand; now, in order to give the audience the key to this apparently surprising feat, that the trumpet was thrown out while their hands and feet remained tied up, I took the trumpet between my teeth, went with it thus to the front of the platform, so that all could see me, and then threw it forward; I kept my hands on my back, so as to make all understand that such a thing may be done without the use of hands, or with the hands tied up. I supposed that this ocular demonstration would suffice for my purpose without further oral explanation. Imagine my surprise, when, after the exhibition was over, a few apparently intelligent gentlemen came to me and declared that the most wonderful thing they "had seen, during the whole performance was that trumpet sticking to your nose!"

I ask, when there are such people to see this kind of performances, is the wonder that they are taken in?

As at that time I occupied the chair of Natural Philosophy and Chemistry in the Cooper Institute, and lived in the building, where also the Davenports performed in the large hall, while their cabinet remained there, during the whole time of performance (about a fortnight), I had easy access to it, and could practically verify all my theories in regard to every item of the performances, of which this is a first specimen.

Are the American Women Deteriorating?

R. R. McIlvaine, M. D., formerly of Cincinnati, in remarks before the Ohio State Medical Society, 1871, on the Special Report of the Committee on Sanitary Science, gave the following statistics as proofs that women are not deteriorating. He said: In 1850, if I remember rightly, in every 2,178 of the entire population of the United States, there was one over 90 years of age, and in every 25,000, in round numbers, there was one over 100 years of age. Mr. President, it is not I who speak, it is history. It is the Bible of politics and progress, the census of the United States for 1850, that I credit with these facts.

But further, the State of New York in 1860 had a white population of 3,831,500; of this number there were 1,646 persons over 90 years of age—namely: 704 men and 942 women; thus, in every 2,327 there was one over 90, and in every 41.647 there was one over 100 years; in both cases women being in the majority.

In the State of Ohio, in 1860, with a white population of 2,302,808, there were 760 over 90 years of age; of this number there were 366 men and 394 women, and therefore there was, in every 3,030, one over 90 years of age, and in every 33,864, one over 100 years of age. In this case, as in that of New York, aged women are in the majority.

In Virginia, in 1860, with a white population of 1,047,299, there were 245 men and 296 women over 90 years of age (total 541), which gives one over 90 in every 1,935, and in every 15,178 there was one over 100 in her entire white population.

In 1860 the white population of the State of Vermont was 314,369. In this small population there is evidence of vitality; there were, over 90 years of age, 146 men and 180 women; and here, as in all the States named, women have the majority. In every 961 there was one over 90, and over 100, 13, being one in every 24,182 of her entire population.

This tabulated view of each section, east, west, north, and south, proves conclusively that we are not deteriorating.

The entire white population in 1860 of the United States was 26,690,206. Of this number, one in every 2,775 and a fraction was over 90 years of age. Of this population, there were 902 over 100 years of age, making one in every 29,578 and a fraction.

RUBY glass is produced by the addition of suboxide of copper to the glass. This ingredient can be got by adding grape sugar in solution to sulphate of copper, then adding caustic potash in excess, then boil. The deposit of suboxide of copper is separated by filtering and washing.

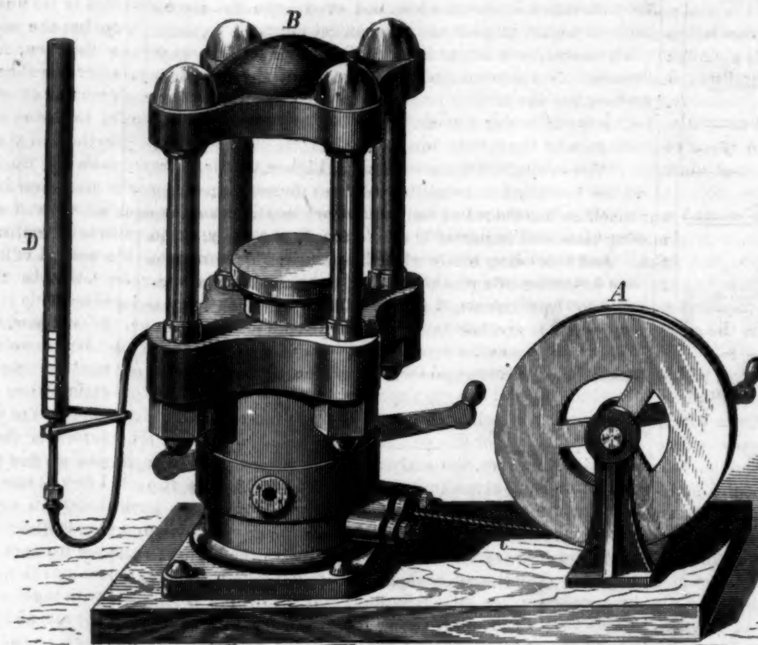
STERHYDRAULIC APPARATUS.

Barnard, in his report on the Paris Exposition, styles this the most ingenious and most decidedly original form of hydraulic press and hydraulic pressure apparatus exhibited. These presses are called by their inventors—Messrs. Desgoffe and Ollivier—their "*Appareils Sterhydrauliques.*" It is from the report alluded to that the substance of this article is extracted. If the etymology of its name does not explain the principle of the contrivance, it will be seen to be at least in harmony with it, when the principle is known. The object of the apparatus, in all its several forms, is to produce a powerful hydrostatic pressure by introducing, into the cylinder of a hydraulic press already filled with liquid, not an additional amount of liquid by successive impulses, as is the case in the common hydraulic press, but a solid substance, by a steady, unintermitted movement. Or, in the words of the inventors themselves, the *Appareils Sterhydrauliques* have for their objects—

"1. To obtain a gradual pressure, without jars, by means of a liquid hermetically enclosed in a recipient which it fills, and to do this by the forcible introduction of a solid body into the recipient.

"2. To utilize this pressure by means of one or of several pistons."

The sole difference—but it is a radical difference—between the old and the new forms of hydraulic press, consists in the manner of applying the power. In the common hydraulic press, the force exerted through the piston of a small forcing pump is intermittent, and acts by fits or jolts. But in these contrivances, the motive power is employed in introducing continuously a flexible cylinder or solid cord, by winding it on a pulley which is enclosed within the apparatus, while it is operated by a crank or a band wheel on the outside. The pressure produced is therefore gradually and uniformly raised; and it acts upon a piston moving watertight in a cylinder, as usual.



DESGOFFE & OLLIVIER'S STERHYDRAULIC APPARATUS.

The construction of a press of this kind is illustrated in our engraving. A is an external pulley on which is rolled the solid cord, B, which is represented as at the same time partially rolled on the internal pulley. This internal pulley is enclosed in a strong metallic chamber which communicates with the cylinder in which moves the large plunger, B. The driving power acts on the internal pulley, increasing the volume of the mass rolled upon it, and thus, through the confined liquid, acting upon B. By applying the power to the pulley, A, and reversing the motion, the cord may be unwound and withdrawn; thus relieving the hydraulic pressure and causing the piston, B, to reenter under the ordinary pressure of the atmosphere. Although the pressure is thus applied gently and gradually, it may nevertheless be much more rapidly raised than it is usually convenient to raise it, in the ordinary form of the pump. For, by deriving the force applied from the motor of a manufacturing establishment, the pulley may be driven with a velocity which would probably soon derange a forcing pump of corresponding capacity. The packing of the piston and of the axis of the pulley is made of raised or upset leather, as is usual in air pumps. That of the cord is simply combed hemp. The liquid in the interior of the chamber is oil, and the material of the cord is catgut. This material is easily fashioned to a uniform diameter; it takes a high polish; it is nearly incompressible and inextensible: it is unalterable in oil; and finally, its flexibility adapts it admirably to the purpose to which it is here applied. A diameter is generally given to this cord of four tenths of an inch. As to the security of the joint formed between the cord and its hempen packing, though some apprehensions were at first entertained, they have been entirely removed by experience. The hemp itself becomes after a time so compacted as to form something like a tube of horn, exactly fitting the cord. For five months a press of this description in daily use has lost nothing by leakage, nor has it been found necessary to tighten the joint.

In the construction of this press, as the chamber for the liquid is formed of a single casting, the pulley has to be introduced through the opening left for the piston. Its size being too great to allow this to be done in a single piece, it is originally formed of two equal parts, which are united on the axis.

A pump of this kind has been constructed for Mr. Tresca, of the *Conservatoire des Arts et Métiers*, to be used by him in the course of his investigations on the resistance of materials of construction, and the flow of solid bodies. It received, for the convenience of these experiments, the horizontal position, and was designed to exert a force of 50,000 kilogrammes. In these investigations, the hydraulic press presented the only available means of applying the immense pressure necessary; but the intermittent and jerking action of the press, as operated by a forcing pump, had the effect of determining fracture of the masses compressed before the limit of their resisting power to dead pressure had been reached. The perfectly steady action of the sterhydraulic press completely remedied this imperfection, and eliminated the irregularities which had disturbed the exactness of the determinations.

The ordinary form of the press with vertical movement is shown in our engraving.

In this figure, a manometer, D, appears attached to the press, to serve as an indicator of the degree of compression. This is important in experiments on the resistance of materials to crushing weights.

There is one consideration which requires attention in presses constructed on this principle, when it is necessary that the piston shall have a large movement. As the quantity of cord accumulated on the pulley increases, the resistance to the driving force increases in virtue of the enlargement of the radius by which it acts. And this unfavorable effect occurs at that part of the course where the pressure on the piston is greatest; and where, accordingly, the mechanical advantage of the motive power ought rather to be increased than diminished. To provide for such cases, the inventors have devised a form of construction where the pulley is smaller but the chamber is elongated, and a second pulley is introduced at the opposite extremity; the cord being in this case rolled about both the pulleys, while much the larger part of its mass occupies the interval between them.

A case may, however, occur in which a very large piston may have to make so long a course as to render it inconvenient or practically impossible to meet the exigency by the expedients thus far described; inasmuch as the quantity of cord required for the purpose might be a troublesome encumbrance. Should, therefore, this difficulty present itself, the sterhydraulic apparatus is constructed in the form of a continuously acting pump, and is employed to introduce liquid into the cylinder of the press, as is done in the ordinary hydraulic press, only that the entrance of the liquid takes place still in a steady and uniform flow, and not by the spasmodic action which it is so desirable to avoid.

Progress and Popular Science.

M. Sogg, of Neufchatel, writes to the editor of *Les Mondes* as follows:

"Since the world is inclined to ridicule your attempt to popularize science, permit one to sit down by your side and induce you to read what I have written on page 128 Vol. II, of my "Treatise on Chemistry," which you must have received long since. What is the science, which loses itself in the clouds of thought without a desire ever to come down to the practical, other than an error, the glory of standing by the side of those other honors which elevate the individual and debase the nation? What would astronomy be if it did not serve to measure time and to guide us on our way upon the land and the sea? To separate pure science from applied science, is to condemn each to sterility; they can no more exist alone than our heads can exist without arms and legs.

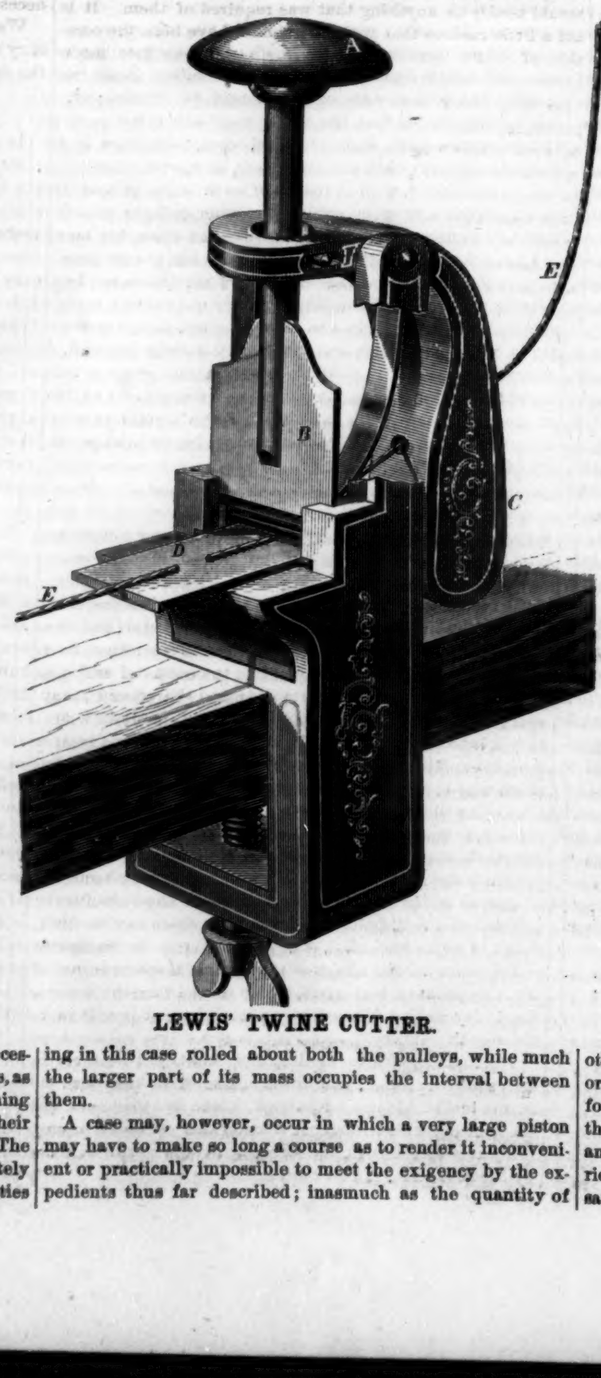
"Thénard would be forgotten if he had not found the cobalt blue which bears his name; it is alkalimetry and alcohometry which have rendered popular the name of Guy-Lussac, and, in spite of all his admirable works, the name of Chaptal would be forgotten if he had not connected it advantageously with the manufacture of beet root sugar.

"Consider how the intelligence of most of our great men is developed, and you will find always that they step upon the scientific stage with works as brilliant as they are useless to human society; later on and gradually, experience, the daughter of age, teaches them to devote themselves to practical application, and they are more pleased with and more proud of having perfected an industrial process, found the formula of a fertilizer, or discovered a new aliment, than if they had devised one of those brilliant theories which flash across the scientific heaven, like falling stars in the space of the firmament, and leave no trace behind."

LEWIS' TWINE CUTTER.

The accompanying engraving illustrates an ingenious and extremely convenient twine cutter, for use in stores, warehouses, etc., for cutting the cords employed in tying packages.

The construction and utility of this neat device will be apparent on reference to the engraving.



LEWIS' TWINE CUTTER.

A knob, A, is attached to the stem of the blade, B, the latter working vertically in guides. When the blade is struck down by the action of the hand on the knob, it raises the outer end of the lever weight, C, the connection of the stem of the blade and the lever weight being made by a pin and slot. When the hand is removed from the knob, the outer end of C drops and raises the blade again.

The part of the twine, E, to be cut, rests on a movable table, D, during the cutting, and is fed from the ball or spool through a hole in the outer part of the weight, C, thence under the end of a spring which holds it firmly down upon the table, and thence under a small wire guard just behind the knife, which holds the end of the twine from lifting, when the knife rises. The end of the twine, being thus held to the table, moves with it. The table slides back and forth, being connected to the outer end of the lever weight by a link which draws it backward, as the knife descends and the outer end of the lever weight rises, and is thrust forward again when the weight falls, carrying the twine with it so as to place the cut end in convenient position to be grasped when wanted.

In use, the twine is drawn out, wound around the package, and tied, when a slight blow upon the knob cuts it off. The hand being removed, the instrument at once resumes the position for a successive operation; in other words, it holds the twine, cuts it, and hands it back to you.

Patented through the Scientific American Patent Agency, Nov. 7, 1871, also in England, by Chas. C. Lewis, Gainesville, Ala. [See advertisement on another page.]

LIQUID POLISH.—The preparation of blacklead ready for use in a fluid state, is a recent English invention. The composition adopted consists of black lead, such as is used for polishing stoves and for other uses, combined with turpentine, water, and sugar or saccharine matter, and the proportions which have been found to answer well are, to each pound by weight of the blacklead, one gill of turpentine, one gill of water, and one ounce of sugar; but these proportions may be varied, and in some cases all the ingredients are not necessary.

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Contents:

(Illustrated articles are marked with an asterisk.)

WHAT IS A MACHINE?

We venture to say that nine out of every ten mechanics would be puzzled to give a satisfactory answer to the above question. We mean, by a satisfactory answer, such a definition as will clearly apply to a machine and to nothing else. This is no proof of lack of intelligence on the part of mechanics, since no less a lexicographer than Webster has failed to give a good definition of the term. At least one out of ten mechanics should be able to give as good, if not a better one.

Webster says a machine is "in a general sense anything used to *augment* or regulate force or motion. The simplest machines are those usually denominated the six mechanical powers, namely, the lever, the pulley, the axis and wheel, the wedge, the screw, and the inclined plane." "More properly, a machine is a complex structure, consisting of a combination or a peculiar modification of the mechanical powers."

Now the first of these definitions is simply absurd, since we know that no machine ever augmented or diminished a force, considered as a force, or ever regulated anything but motion. The second is defective because, to be defined by it, a machine must include all the mechanical powers above enumerated, and cannot include more. But we need not say to mechanics that endless chains, and belts, and flexible cords, are parts of some machines.

We shall find, if we succeed in giving a better definition, that we must get down to a broader foundation for it. We cannot describe machines in general so as to convey any idea of what is common to all of them without first clearly perceiving what is accomplished by the use of any machine. Practically, moving matter is all the force with which machines deal. Falling water, expanding steam, the movements of animals, air currents, molecular motion of magnets converted into mass motion in the armatures, etc., these are the moving agents of machinery. The direct application of what is called abstract force has never yet and never will be made to move a machine.

Beginning, then, with matter in motion, and applying this motion to machinery, let us see what is and what is not accomplished. First we find that the amount of motion applied, that is the weight of the primarily moving mass multiplied into its velocity, is not affected in any way by our machine. When we have summed up the amount consumed in friction, the momenta of the moving parts, the amount consumed in giving to the machinery its standard velocity, that consumed in overcoming resistance of the medium in which the machine moves, and that which is finally converted into useful work, we find the sum always equal to that part of the momentum of the primarily moving mass which we have used to impel our mechanism.

But we discover that whenever we use machinery, we change the direction of motion. If we throw a block of wood upon the bosom of a river, the block will be carried along to the ocean, and a certain amount of work will have been done. The wood, however, has not been an instrument in the accomplishment of the work; it has only been passive, acted upon, but not transmitting motion. It is not a machine. Let us make this block a means of transmitting the motion of the stream to other matter, and it becomes a machine. In order to do this we restrain its motion at some point,—say its center. It begins to revolve, because its movable exterior still is actuated by the current, while its central axis is kept stationary. It is now an undershot water wheel, and capable of performing work.

Let us try to do some work with it. The simplest thing we can do is to cause it to raise a weight on its ascending side. We have here the conversion of the horizontal motion of matter into vertical ascending motion. Strictly speaking, our machine has therefore only conveyed motion from one moving mass and imparted it to another *in a different direction*. And this being solely what the elements of machines do, our definition of a machine is, an instrument, or a combination of instruments, for transmitting power from one moving mass to another in a different direction. Whatever complex results may be produced, this, and this only, is the common characteristic upon which a definition can be based.

POISONING BY ANTIMONY.—THE WHARTON TRIAL.

An important trial, for an alleged murder by antimony, recently pending in Annapolis has attracted unusual notice in consequence of the conflicting character of the testimony offered by scientific men summoned as experts. One of the witnesses testifies in the most explicit terms to having found antimony, but, when cross-questioned as to the methods pursued for arriving at this knowledge, he gives such tests as are no longer regarded as of any value by chemists, and his testimony is flatly contradicted by experts who have kept up with the progress of modern research and are familiar with the best methods at present employed for the detection of poisons. "When doctors disagree, who shall decide?" We suppose the jury in this case, but upon what principles they are to weigh the evidence and determine who of the numerous learned men are to be believed and who discarded, is not stated. We suppose that nobody outside of the jury box, and we trust nobody in it, will be deceived by the mist and obscurity that the lawyers have attempted to throw around a very clear subject by dragging certain ignorant men upon the stand to take the position of experts. All of the chemists of learning and experience would agree, but it would be easy enough to find numerous charlatans who would testify to anything that was required of them. It is not a little curious that antimony should have been the occasion of bitter controversies ever since it was first made known. It was first described by Basil Valentine about the time of the discovery of America by Columbus. This worthy monk, residing in Erfürth, Germany, was wont to try numerous scientific experiments between his *aves* and *paters*, and is reported to have given some antimony to the convent hogs for the purpose of fattening them. The animals gained in flesh amazingly, and the benevolent father thought that it would be a kind act to repeat the experiment upon his lean and fasting brethren. This time the result was not so favorable, and several of the priests died. "What will cure a hog will kill a monk" was the verdict of the time, and the metal which caused the mischief was called *anti-moine*, death to monks; and we now call it antimony. Notwithstanding the unfavorable issue of Valentine's prescription, antimony became one of the most popular medicines of the day, and its use, or rather abuse, was carried to such an extent that in France in 1566 a special edict was promulgated against its employment as a medicine, which law was not repealed until after the lapse of a hundred years. Very few of our elementary bodies have been subjected to so much study and investigation as antimony, and one would suppose that by this time all of its properties and relations ought to be pretty thoroughly understood; and they are fully known to chemists of any claim to the title of scientific men. As the salts of antimony are frequently employed in medicine, and can consequently be purchased without exciting suspicion, they have long been the favorite agents, in the hands of evil disposed persons, to be used for poisoning. No doubt many persons have been the victims of this poison without suspicion; and in most cases where suspicions have been aroused, and the persons who gave the medicine have been tried before the courts, it has not been found very difficult to acquit the accused, chiefly on the ground that the deceased may have taken the antimony as a medicine. In the case of arsenic this remedy does not hold, as that dangerous substance can hardly be called a medicine. One of the most remarkable cases of the accidental employment of a large quantity of a salt of antimony occurred in Göttingen, Germany, in 1861, on the occasion of the annual fair in that city. It transpired on investigation that a baker had used a large quantity of tartar emetic instead of saleratus in mixing flour for a peculiar kind of gingerbread much coveted in that region of country. The number of persons poisoned by this cake was so great as to bring about a thorough judicial investigation which led to the discovery of the above facts. In 1865, Dr. Pritchard, of Glasgow, Scotland, poisoned his wife and mother-in-law by administering overdoses of tartar emetic; and in the famous case of William Palmer, there was also much talk of antimony.

It is not necessary for us to follow the evidence adduced by the prosecution at Annapolis to prove that death was caused by antimony, as the daily press has given full details of the trial; but it may be well to mention some of the properties of antimony, together with the tests that ought to be applied for its detection. A preliminary step in all such investigations is the previous examination of all of the utensils and re-agents to be employed. It often happens that reagents, purchased as chemically pure, are on examination shown to be largely contaminated by foreign substances. This is particularly the fact with such common chemicals as sulphuric and hydrochloric acids. Even ammonia, derived as it now is from the dirty refuse of gas works, is nearly always impure, and liable to occasion disturbances in some of our most important remedies. The apparatus used in a search for poisons should be absolutely new and clean. After taking all of these preliminary precautions, the chemist is in condition to enter upon his examination. The modern chemist would be apt to make an early test with the spectroscope. This instrument reveals, with unerring certainty, the least trace of any volatile substance, and is invaluable in all cases of suspected poisoning. Antimony gives a multitude of brilliant rays more numerous than those afforded by the spectra of other metals; the most prominent lines are to be found in the orange, green, and violet portion of the spectrum.

It is somewhat remarkable that in the recent Annapolis trial so little stress should have been laid upon spectrum analysis. After the spectroscope, usually follows electrolysis, or the decomposition of the substance by electricity; in the case of antimony the product obtainable in this way depends upon the form of the experiment, strength of current, etc. Sometimes we find the metal at the negative pole in a crystalline condition, then again gray and hard, with a specific gravity of 6·6. The amorphous antimony obtained by electrolysis is characterized by its explosiveness on percussion. Passing from the action of light and electricity, the chemist would take up the tests described in so many books that we wonder where some of the Annapolis experts found the methods practised by them. Even traces of antimony can be found by any of the following methods:

1. By passing sulphuretted hydrogen through an acid solution and subsequent comparative tests to distinguish the precipitate from arsenic. 2. The copper test. 3. The Marsh test, to which however, in recent times, many objections have been raised. In all cases of importance, as in a trial for murder, the metal ought to be produced in court, and the specimens obtained, by the reactions described above, ought to be also kept for exhibition. The spectrum analysis would have to be taken on faith, unless the court room was provided with conveniences for throwing the lines upon a screen. Our knowledge of antimony is so accurate, and the researches into its propensities extend over so many centuries, that ignorance just now is wholly inexcusable, and all wrangling unnecessary.

We only need to turn to any standard text book on chemistry to obtain all the information that we may require on the subject.

HEALTH AND DISEASE.

In glancing over a medical journal, the other day, we stumbled upon the assertion that the lack of knowledge upon the treatment of cancer is a disgrace to the medical profession. If this be so, how much honor ought to be given to a profession which can neither determine cause nor cure of apparently far more simple diseases than cancer, and of which it may be said that the most intelligent and skillful physicians now cease attempting to cure? We seriously question whether there is one half of the diseases, enumerated in any good work on the practice of medicine, which the best practitioners dream of curing. They simply let these diseases have their course, taking care that nothing except the complaint shall obstruct the patient's return to health. Nature does the fighting with the malady, the physician sees that it is a fair fight, and that the recuperative power of the constitution shall not encounter bad nursing, bad diet, bad air, nor the bad companionship of depressing mental influences.

If you ask a skillful physician what is health, he will glibly run off a formula, of excellent sound and seeming sense. He has another equally well sounding formula which is his definition of disease. Ask him to apply these formulæ, and you will see that, while marked variations from the general standard of health are easy to determine, the precise nature of the variation is, in most cases, as absolutely unknown to him as to the laymen. There are certain characteristics of diseases to the majority of which, when they appear, he gives a name. He says such a patient has the small-pox, another phthisis, another measles, and so on. These names only characterize groups of appearances; they give no clue to the real nature of the complaint.

Notwithstanding what we have said, we assert that the medical profession is worthy of honor; and that no better advice can be given, to a patient who is sensible enough to distinguish between dosing and doctoring, than to obtain in sickness the counsel of a really able physician. For despite all the obstacles which have intervened to prevent accurate knowledge of the hidden characters of disease, there is something known. Physicians are beginning to know how little they know, which is a long stride toward rational practice.

A skilled practitioner, formerly a lecturer in a medical institution, said to us in a recent conversation: "The medical practice of the future is to be essentially hygienic." This statement is most significant. Physicians are gradually relinquishing their faith in drugs, and placing their trust more and more in the recuperative power of their patients. Less calomel, rhubarb and jalap, and more pure, sweet air, more

good food and drink, more cleanliness and good companionship to prevent mental depression and discouragement, with rest, are the medicines now fast becoming popular; and they are so good to take, that they are gratefully received rather than rejected by the sick.

It is true that antidotes to certain blood poisons have been found (quinine seems to be such an antidote), though the real nature of the poisons is yet unknown. In cases where such antidotes are ascertained, it may be wise to use drugs, though we cannot explain how they act to remove the cause of the malady; but there are comparatively few such remedies in the *materia medica*. Indeed, it has been one of the articles of faith of the allopathic school, that there is no such thing as a specific remedy. We believe that this dogma is destined to be replaced by just its opposite, namely, that any drug, in order to be styled a remedy, must be demonstrated to have a specific action upon the disease for which it is administered.

The present state of medical science is the natural result of the general progress of the time. Old superstitions are recognized in their true character through the light of modern science. The microscope, the spectroscope, the chemist's paraphernalia have given us some insight into the action of certain substances when introduced into the human system, that shows the belief in their efficacy to be unfounded. Through chemistry the science of pathology and therapeutics will advance, but the latter will doubtless advance by the elimination of a vast number of the agents hitherto employed in the healing art. If new ones are added, it will be on grounds more scientific than the blind empiricism of the past. Empiric conclusions hereafter must be of that positive character which leaves no room for doubt; and though sickness can never be pleasant, the coming sick man need not fear that artificial horrors will be added to the couch of pain, through the administration of nauseating medicines of uncertain value, and the deprivation of all external appliances that can sooth and comfort, and reconstruct his shattered system.

If he is thirsty, he will have cool drinks. He will have a nice clean bed, well aired. His parched skin will be well washed with pure water. His room will be thoroughly ventilated and infected. Instead of depletion by blistering, bleeding, and purging, he will be treated to nourishing and easily digested broths and viands; and regard will be paid to what were once called his abnormal cravings and desires. His apartment will, in short, be made a haven of peaceful rest, into which he puts for repairs, and from which, if not a total wreck when he enters it, he may emerge patched up in the most scientific manner, by the same hand that built him—Nature—the good old architect, who knows what she is about, and only asks, of doctors and nurses, that they should clear away the rubbish and let her have her own way in the matter of healing.

THE STUDY OF ALLOYS.

We have repeatedly called attention to the great importance of the systematic study of alloys, and have pointed out that the only way, to prosecute such a study with any hope of success, is in a well endowed metallurgical laboratory, supplied with ample apparatus, and a zealous corps of thoroughly trained investigators; the researches to be continued, if need be, through half a century, or until the field has been thoroughly worked over. The subject is so extended that few investigators will attack it single handed, except to make disconnected and unconclusive experiments. We have never realized this truth so forcibly as when reading Fesquet's translation of Guettier's "Treatise on the Manufacture of Alloys," which has recently been forwarded for notice by the publisher.*

In the introduction to this work, the acknowledgment of incompleteness is frankly made, and the impossibility of a strict and exact method is confessed. In the present state of knowledge upon the subject of alloys, we grant the impossibility, but are not willing to concede that our knowledge might not be so extended as to form a solid basis for such a method. Surely the number of possible combinations of metals is not so great as those of organic substances, nor are their properties so various. Yet we have an exact method in works on chemistry.

We object also to the classification of metals, adopted in the work, which is utterly unscientific. That the reader may understand the ground for this objection, we give the classification as found on page vii of the introduction:

1st. The metals especially industrial, that is to say, those which are most in use in all kinds of manufactures. They are: Copper, tin, zinc, lead, iron, steel, etc.

2d. The metals which belong to the arts, but whose importance is secondary. These are: Bismuth, antimony, nickel, arsenic, and mercury.

3d. The precious metals which belong to the arts, or more particularly to the manufacture of objects of luxury. These are: Gold, silver, aluminium, and platinum.

4th. The metals scarcely used in industry or in alloys, most of them being, at present, without any clearly demonstrated usefulness.

For the purposes of the work, this classification answers tolerably, but it fails to give the reader any idea of those properties possessed in common by certain metals, by which chemists have agreed to group them in classes. Without keeping these groupings constantly in view, we believe no study of alloys can be pursued that will be important to science. Isolated discoveries of peculiar combinations are possible, and, from time to time, will be made, but these discoveries can never lead to generalizations, and our knowledge will therefore remain in the crude, uncompacted state, of which this book is a striking example, until some such course as we have recommended be adopted.

We find nowhere in the work a definition of the term alloy, and though a distinction is made between alloys formed of definite proportions, (chemical alloys), and those which are defined by Mathiessen to be solidified solutions of metals in other metals, this distinction is nowhere sharply defined. In short, the reader may arise from the perusal of this book with scarcely more theoretical information than he had at the beginning.

If this criticism seems severe, we will strive to do equal justice to the merits of the work, which are so numerous as to render it of very great general value. As a practical guide which is all that is claimed for it in the title, it is far superior to anything we have ever met upon the subject. In fact, we do not believe another work exists, to which engineers, artizans, manufacturers and inventors, can turn with full confidence for the instruction afforded in this treatise. To the brass and iron founder, the model maker, the general mechanician, its aid must prove invaluable, especially that found in the chapter on the "Preparation and Composition of Alloys," which, if properly studied, is a chart by which the errors of inexperience may be easily avoided. The method of procedure is of great importance in the production of many valuable alloys. To throw the metals together hap-hazard is, in most cases, to insure failure. We are often asked by correspondents to set them right in matters of this kind, and know how general is the want of accurate information upon the subject.

The following quotation will illustrate more fully the necessity of pursuing a definite routine in the admixture and combination of metals:

"In general, it is advantageous to introduce into the alloys a certain number of elements, even in small proportions for many of them, and although several of these elements would not appear to possess an appreciable utility, or have an important effect. The results of affinity obtained by the new elements favor the mixtures, increase the density and the homogeneousness, at the same time that they sometimes counterbalance, with great advantage, the tendency to liquation or separation in the melted mass.

"Thus, for instance, a statuary bronze, which could be made entirely of copper and tin, acquires new and indispensable qualities by the addition of zinc and lead, even in small proportions.

"As another example, the alloy of copper and zinc, which as such might be suitable for certain uses in the arts, becomes much more valuable for these same uses, and is improved and completed, by the addition of a small proportion of tin or lead.

"The more complex an alloy is to be, the more important is it that its preparation should be effected by the union of more simple alloys, previously made. Outside of the considerations which guide the founder as to the order in which the metals should be melted, such as the peculiar conditions of affinity, the similitude in the specific gravities and the points of fusion, it is proper to examine the means and processes by which we add, to the final melting, those metals whose proportions in the alloy are comparatively small."

Of scarcely less value is the discussion of the properties of special alloys, and their applications to useful purposes in the arts. The list is very full, and the proportions are in all cases fully stated, and, when necessary, special directions are given. It would be strange if some alloys of recent date, and not yet generally introduced, had not been omitted, yet we have been able to recall very few not comprised in this department of the work.

*A Practical Guide for the Manufacture of Metallic Alloys, Comprising their Chemical and Physical Properties, With their Preparation, Composition and Use. Translated from the French of A. Guettier, Engineer and Director of Foundries, Author of "La Fonderie en France," etc., etc. By A. A. Fesquet, Chemist and Engineer. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut street. London; Sampson Low, Son & Marston, 188 Fleet street. 1872. Price by mail, postage free, $3.00.

ARTIFICIAL FUEL.

We publish, in another column, the report of a committee of the Franklin Institute on a trial of artificial fuel. In connection with this report, some general remarks upon the subject may be useful.

It is commonly supposed that the primary object, in the production of artificial fuel, is the utilization of waste; but there are other important ends that may be secured, which ought not to be lost sight of in the general consideration of the subject. One of these is the production of fuel better suited to certain industrial operations than that obtained in the crude form. The process of coking coal for iron working is a striking example in point. By this process, the sulphur, in the coal, which is injurious to iron is removed, and the coke is made to approximate in purity to charcoal, with which the best iron is made.

The manufacture of charcoal is another familiar example of the artificial preparation of fuel. By this process, we get a fuel which burns with scarcely any smoke, is free from substances contained in the natural wood, and is thereby much better for many uses than wood previous to distillation.

We see then, that the artificial preparation of fuel does not necessarily look to cheapness as the sole end to be secured; in fact, this point may, in some cases, be entirely ignored with a large demand for the fuel produced, provided it has qualities that compensate for increased cost. To utilize waste and thus make a cheap fuel is, however, the chief end sought by inventors, who aim at reducing coal slack to a form convenient to use for domestic or manufacturing purposes.

There are, probably, very many ways in which this may be done, not yet hit upon by inventors. The one described, in the report alluded to, is undoubtedly a good one, and there are others in use which give excellent results. One important thing in domestic fuel is that it shall be comparatively free from dust. A slight increase in the percentage of ash is not to be regarded as a serious defect. Such increase gives little trouble, and does not lessen greatly the heating capacity of the combustible ingredients. It adds a little to the trouble of attending fires, but this is a trifling inconvenience.

We believe that the form of the lumps or blocks of artificial fuel is a matter of more importance than it is generally considered. If made with sharp corners and angles, as is usual, these corners break and crumble in handling and transportation, and a disagreeable and filthy dust is created, which might, we think, be avoided in a great measure by a different form. Some of this kind of fuel is also not sufficiently dense to make a fire that will keep sufficient time. Others are not sufficiently tenacious in texture to prevent crushing and crumbling.

In short, there is still room for much invention in this department, and we look to see the manufacture of artificial fuel take its place, in the future, among the great industries of the world.

THE AMERICAN MASTER MECHANICS' ASSOCIATION.

This association is proving itself a really working organization, and is as ably managed as anything of the kind in America. At its last annual convention, September 12, 13, and 14, 1871, held at Louisville, Ky., some very able papers were read, and much valuable information elicited. The following list of subjects for discussion shows that the association means business. The selection is most judicious, including

Boilers and boiler material.

Boiler incrustation.

Boiler explosions.

Safety valves.

Construction of valves and valve gearing.

Steel tires.

Best method of securing driving and truck brasses.

Best method of constructing tender trucks.

Is there any method or device for packing stuffing boxes, more economical than hemp?

Application of compression brakes.

Comparative performance and cost of operation of eight and ten wheel engines for freight service.

Comparative performance and cost of operation of ten wheel engines with six drivers coupled, and eight wheel engines with four drivers coupled.

Uniform system of computing mileage of engines doing switching service.

Uniform system of examination for promotion of locomotive firemen.

Advisability of establishing different grades of locomotive engineers according to length of service, character, etc.

THE AGASSIZ EXPLORING EXPEDITION---INTERESTING RESULTS ALREADY OBTAINED.

We recently chronicled the departure from New York of a deep sea exploring expedition, under the lead of the venerable Professor Agassiz, on a voyage round the world, authorized by the United States Coast Survey. We are already beginning to receive interesting accounts of results obtained by members of the expedition, some of which are narrated in the following interesting letter:

ST. THOMAS, W. I., Dec. 15, 1871.

PROFESSOR AGASSIZ TO PROFESSOR PIERCE.

My Dear Professor—For several days after we left Boston, I was greatly troubled by a sense of general weakness, so much so that more than once I thought I had undertaken more than I had strength for. But as soon as we got into warmer latitudes, I felt better, and now I am actually improving beyond my condition at the start. As soon as we reached the Gulf Stream, we began work. Indeed, Pourtalès organized a party to study the temperatures as soon as we passed Gay Head, and he will himself report his results to you, which are quite interesting. My attention was entirely turned to the Gulf weed and its inhabitants, of which we made extensive collections.

SEA WEEDS AND THEIR INHABITANTS.

Our observations favor the view of those who believe that the floating weed is derived from plants torn from the rocks, upon which sargassum naturally grows. I made a very simple experiment, which seems to me to settle the matter. Every branch of the sea weed which is deprived of its floats at once sinks to the bottom of the water, and these floats are not likely to be the first parts developed from the spores. Moreover, after examining a very large quantity of the weed, I can say that I have not seen a branch, however small, which did not exhibit distinct marks of having been torn from a solid attachment. You may hardly feel an interest in my zoölogical observations; but I am sure you will be pleased to learn that we had the best opportunity of carefully examining most of the animals known to inhabit the Gulf weed, and some which I did not know to occur among them.

DISCOVERY OF FLOATING FISH NESTS.

However, the most interesting discovery of the voyage thus far is the finding of a nest built by a fish, floating on the broad ocean with its live freight. On the 13th of the month, Mr. Mansfield, one of the officers of the Hassler, brought me a ball of Gulf weed, which he had just picked up, and which excited my curiosity to the utmost. It was a round mass of sargassum, about the size of two fists, rolled up together. The whole consisted, to all appearance, of no-

thing but Gulf weed, the branches and leaves of which were, however, evidently knit together, and not merely balled into a roundish mass; for, though some of the leaves and branches hung loose from the rest, it became at once visible that the bulk of the ball was held together, by threads trending in every direction among the sea weeds, as if a couple of handfuls of branches of sargassum had been rolled up together with elastic threads trending in every direction. Put back into a large bowl of water, it became apparent that this mass of sea weeds was a nest, the central part of which was more closely bound up together in the form of a ball, with several loose branches, extending in various directions, by which the whole was kept floating.

A more careful examination very soon revealed the fact that the elastic threads which hold the Gulf weed together were beaded at intervals, sometimes two or three beads being close together, or a bunch of them hanging from the same cluster of threads; or they were, more rarely, scattered at a greater distance one from the other. Nowhere was there much regularity observable in the distribution of the beads, and they were found scattered throughout the whole ball of sea weeds pretty uniformly. The beads themselves were about the size of an ordinary pin's head. We had, no doubt, a nest before us, of the most curious kind; full of eggs too, the eggs scattered throughout the mass of the nest and not placed together in a cavity of the whole structure. What animal could have built this singular nest, was the next question. It did not take much time to ascertain the class of the animal kingdom to which it belongs. A common pocket lens at once revealed two large eyes upon the side of the head, and a tail bent over the back of the body, as the embryo uniformly appears in ordinary fishes shortly before the period of hatching. The many empty egg cases observed in the nest gave promise of an early opportunity of seeing some embryos freeing themselves from their envelopes.

THE EGGS HATCH OUT.

Meanwhile, a number of these eggs with live embryos were cut out of the nest and placed in separate glass jars to multiply the chances of preserving them, while the nest as a whole was secured in alcohol, as a memorial of our unexpected discovery. The next day I found two embryos in one of my glass jars; they occasionally moved in jerks, and then rested for a long while motionless upon the bottom of the jar. On the third day I had over a dozen of these young fishes in my rack, the oldest of which begin to be more active and promise to afford further opportunities for study. The pigment cells of a young *chironectes pictus* proved identical with our little embryos. It thus stands as a well authenticated fact that the common pelagic *chironectes* of the Atlantic (named *chironectes pictus* by Cuvier), builds a nest for its eggs in which the progeny is wrapped up with the materials of which the nest itself is composed; and as these materials are living Gulf weed, the fish cradle, rocking upon the deep ocean, is carried along as an undying arbor, affording at the same time protection and afterward food for its living freight.

This marvelous story acquires additional interest if we now take into consideration what are the characteristic peculiarities of the *chironectes*. As its name indicates, it has fins like hands; that is to say, the pectoral fins are supported by a kind of prolonged, wristlike appendages, and the rays of the ventrals are not unlike rude fingers. With these limbs these fishes have long been known to attach themselves to sea weed, and rather to walk than to swim in their natural element. But now that we have become acquainted with their mode of reproduction, it may fairly be asked if the most important use to which their peculiarly constructed fins are put is not probably in building their nests.

LOISEAU'S COMPRESSED FUEL.

HALL OF THE FRANKLIN INSTITUTE, PHILADELPHIA, DECEMBER 19, 1870.

The committee on science and the arts, constituted by the Franklin Institute, to whom was referred for examination specimens of artificial fuel, prepared by Mr. E. F. Loiseau, of Philadelphia, have made the following report:

That they have made trials of the samples produced from anthracite and from bituminous coal.

The mode of manufacture, as related by Mr. Loiseau, is as follows:

1. Anthracite small coal and dust were mixed with (7) seven per cent of clay, and compressed into cylindrical molds about 4½ inches in diameter and 4 inches deep, or else into spherical masses about 3 inches in diameter.

2. The molded masses are placed for a few minutes in a bath of benzine, in which rosin had been dissolved, and from which they are removed, and dried by an exposure to a current of air.

The object of coating them with a film of rosin is to prevent the absorption of moisture and consequent softening of the clay; the solution in benzine penetrates the mass of coal and clay to a depth of about ½ inch, and so efficiently closes the crevices, that samples immersed in water for twelve hours were found dry in the interior when broken up for examination.

Both the anthracite and bituminous fuels were burned in a furnace measuring 9 inches in diameter and 7 inches in depth; each variety of fuel burned freely, and was completely ashed, but the intensity of the combustion was less than that produced by anthracite or bituminous coals of small size, burned in the same furnace. These comparisons were made with a moderate and also with a strong draft.

The average amount of ash obtained from the anthracite artificial fuel was 16 per cent, and, from the bituminous artificial, was 18·5 per cent.

The heating powers, as obtained from trials in Thompson's apparatus, are as follows:

One pound of anthracite fuel, in each of four experiments, gave the results 4·30, 85·0, 7·86, and 6·76 lbs. of water evaporated, being an average of 6·85.; while one pound of bituminous artificial fuel, in each of four experiments, evaporated 9·35, 11·11, 12·88, and 10·61 lbs., averaging 10·99. The anthracite average is 7·40 lbs. of water. The average of bituminous is 14·88 lbs. of water.

The non-uniformity of result is partly due to the imperfect manipulation in mixing the coal and the clay, and partly to the varying amounts of solution of rosin absorbed in the bath to which the material is subjected; the imperfect manipulation can be remedied by the adoption of proper machinery for that part of the process.

The ability of the artificial fuel to bear transportation is less than that of anthracite or good lump bituminous coals, but the structure is firmer than that of many bituminous and semi-bituminous coals that are carried to market. The masses will generally break up with a fall of 3 feet upon a stone pavement, but are strong enough to bear ordinary handling and transportation; and should they become broken, will suffer no damage, unless exposed to wet.

The samples of artificial fuel examined are well adapted for use for purposes in which great intensity of combustion is not desired.

For the production of steam in stationary boilers, and for household purposes, it can be employed equally as well as any ordinary coal; and, whenever the cost of preparation is less than the cost of mining coal, this invention will make available the immense amounts of small coal now allowed to remain useless at the coal mines. It appears to work far better than the balls or bricks of coal dust and clay and lime that came into vogue in this city many years ago, when anthracite was brought to market without preparation by the coal breaker, which had not then been invented; the balls or bricks thus made not having the protection from wet secured by Mr. Loiseau, by his resinous coating.

We consider the method of preparing artificial fuel from waste anthracite and bituminous coals, as presented by Mr. E. F. Loiseau, as ingenious and well adapted to the purpose, and worthy of the attention of those interested in the production of a cheap fuel, adapted to a great variety of uses.

Respectfully submitted.

Charles M. Cresson, }
William H. Wahl, } Sub-Committee.
John Wise. }

By order of the Committee,
D. Shephard Holman, Actuary.

[The samples of artificial fuel, presented to the Franklin Institute to experiment upon, were simply pressed by hand and could not be made as solid as they will be when pressed by appropriate machinery.

The percentage of ash is larger than in ordinary coal, as the clay is not consumed; but the other advantages of the artificial fuel, in point of durability, cleanliness, and cheapness, more than compensate this small disadvantage.

The cost of manufacture at the mines, including the coal and all the materials, will, it is stated, not exceed one dollar per tun.—EDS.]

TO CITY SUBSCRIBERS.

The SCIENTIFIC AMERICAN will hereafter be served to our city subscribers, either at their residences or places of business, at $3·50 a year, through the post office by mail carriers. The newsdealers throughout this city, Brooklyn, Jersey City, and Hoboken keep the SCIENTIFIC AMERICAN on sale, and supply subscribers regularly. Many prefer to receive their papers of dealers in their neighborhood. We recommend persons to patronize the local dealers if they wish the SCIENTIFIC AMERICAN or any other paper or magazine.

NEW BOOKS AND PUBLICATIONS.

SCIENCE RECORD FOR 1872. Being a Compendium of the Scientific Progress and Discovery of the Past Year. 400 pages, octavo. 100 Engravings, Steel Plate and Wood. Handsomely bound in muslin, $1.50: extra binding, half calf, $2. Munn & Co., Publishers, 37 Park Row, New York, Office of the SCIENTIFIC AMERICAN.

This new and elegant work presents, in convenient form, notices of the leading subjects and events, pertaining to science, that have occupied public attention during the past year. The progress of the more important public works is duly chronicled, with illustrative engravings. The leading discoveries, facts, and improvements, in chemistry, mechanics, engineering, natural history, and the various arts and sciences, are recorded and illustrated. Sketches of prominent scientific men, with illustrations, are given, and among the portraits are those of Faraday, Murchison, Darwin, Agassiz, Huxley, and Herschel. The Mont Cenis tunnel, the Hell Gate works, the Brooklyn suspension bridge, the Hoosac tunnel, the St. Louis bridge, the United States Patent Office, and other works are illustrated. A large amount of useful information, tables, descriptions of improvements, with engravings, are likewise presented. The book is one of much interest and value, and should have a place in every library.

APPLICATIONS FOR EXTENSION OF PATENTS.

SAWING MACHINE.—Harriet L. Low, Galena, Ill., administratrix of Henry H. Low, deceased, has petitioned for an extension of the above patent. Day of hearing, February 28, 1872.

TURNING AND SLIDING TABLE FOR RAILROAD.—William Sellers, Philadelphia, Pa., has petitioned for an extension of the above patent. Day of hearing, March 6, 1872.

COMBINATION OF LEAD PENCIL AND ERASER.—Hymen L. Lipman, Philadelphia, Pa., has petitioned for an extension of the above patent. Day of hearing, March 13, 1872.

MODE OF PROTECTING GILDING ON GLASS.—Peter V. Mathews, Philadelphia, Pa., has petitioned for an extension of the above patent. Day of hearing, April 10, 1872.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—FUSIBLE METAL.—Is there an alloy, fusible at a lower degree of heat than brass, suitable for small molds of machinery?—J. A. C.

2.—WATERPROOFING BOOTS.—Can any of the readers of he SCIENTIFIC AMERICAN inform me with what preparation I can make boots and shoes waterproof?—C. B.

3.—REMOVING INK STAINS.—Will some reader of the SCIENTIFIC AMERICAN give me a formula for making a preparation that will remove ink from books and papers without injuring them?—B.

4.—TELEGRAPH GROUND WIRE.—How deep should a ground wire be extended to insure a current of electricity at all times of the year? Should it terminate in a mass of metal? If so, how much surface should come in contact with the earth?—T. C. G.

5.—SHRINKING IRON SLEEVES.—Recently, at Albright and Stroh's iron works, Mauch Chunk, Pa., was cast an iron shaft, weighing twelve tuns, in two parts; and an internal and external sleeve was shrunk on to connect the two pieces. The sleeve weighed three tuns. Can any one nform me if any heavier pieces have been shrunk on, in the United States?—T. H. S.

6.—MARBLEIZED SLATE AND IRON.—It is stated by some persons that marbleized slate and iron mantles get damaged by frost and damp, when left without a fire in a house shut up for some months, or perhaps a year or two. Will some of your readers please say if it is true?—T. G.

7.—HORSE POWER.—Can any of the correspondents of the SCIENTIFIC AMERICAN tell me how small a circle a horse can travel in, on an upright horse-power, without injury to health, or making him dizzy? The amount of power required is insignificant. And will covering the horse's eyes make any difference?—L.

8.—STEAM ENGINE POWER.—I have a steam engine that I contracted for to perform a certain amount of work with a pressure of 70 pounds of steam per square inch. But upon trial, it failed to accomplish said work with a pressure of 80 pounds; but, by detaching one fourth of the work, it drives the remaining three fourths with apparent ease with a pressure of only 45 pounds per square inch. The cylinder is 12 x 24 inches, the fly wheel 8 feet in diameter and weighs 3,100 pounds; the latter is hung on a six inch cast iron crank shaft, running at a speed of 96 revolutions per minute. The steam ports give an opening of seven square inches each, the exhaust about fourteen. It is furnished with a Judson two and a half inch governor; the lead pipe from boiler to engine is two and a half inches inside diameter and twenty feet long. After its failure to do the work, the builders propose to replace the two and a half inch governor and valve with a three inch one, leaving on the two and a half inch steam pipe; also to put on a fly wheel en feet in diameter, weighing 4,200 pounds. With the above alteration they claim that the difficulty will be overcome, and it will do the work allotted (about 40 horse power). Whether the builders' idea of increasing the power is correct, and the true cause of the engine not doing one fourth more work with 80 pounds of steam than it will do with 45 pounds, is what I should like to know.—J. R. L.

9.—INDELIBLE INK.—Will some one please inform me how to make an indelible ink for marking linen with a common pen?—C. T. H.

10.—SUCTION PUMP.—The theory that the pressure of the atmosphere pushes the water up the suction pump and pushes the hot air up he chimney and the like, interferes with what a friend of mine is projecting ust now. Will some correspondent please inform me how I can satisfy my friend that it is not the levity of the hot air that causes it to ascend, and so give place to the cold air; and that nature's abhorrence of a vacuum does not account for the water ascending in the suction pump and the like?—P. D.

11.—BRONZE PAINT.—How can I make a surface on smooth ron, in imitation of bronze metal? Is it possible that not one of your thousands of readers who know, will respond?—R. S. B.

12.—BLUEING IRON.—I would like to ask through "Notes and Queries" how the iron work of the most highly finished guns and revolvers is blued.—J. C. C.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

W. S., of Iowa.—The mineral you send is mica, but is an inelastic variety, and of no use in the arts.

BÉTON-COIGNET.—If J. H., query No. 2, January 1, read his SCIENTIFIC AMERICAN regularly, he would remember a full account of this artificial stone, given on page 248, Vol. XXIV.—D. B., of N. Y.

GUN SCATTERING SHOT.—H. W., query No. 3, January 1st, should make his powder and shot into hard, well packed cartridges.—D. B., of N. Y.

CEMENTING LEATHER TO IRON.—E. A., query No. 4, January 1st, can fasten leather to iron by putting pulverized rosin on the flesh side of the leather, and applying it to the heated iron.—D. B., of N. Y.

ATTACHING LEATHER TO IRON.—Can you inform me, through your valuable paper, how to cover the iron pulleys with leather without going to the trouble of riveting? I tried cementing with cement made of glycerin and litharge, but did not succeed.—L. P.—Answer: See No. 4 in this column.

SALT AND ICE.—M. A. wishes to know why salt is mixed with ice to freeze ice cream, while in winter we put salt in our pumps to keep them from freezing. The reason is as follows: The salt has a great attraction for water, and when mixed with ice, it tears down the crystalline architecture of the latter. At the same time the salt itself is dissolved, and both are reduced to the liquid state; but this cannot take place without heat, as it is a thoroughly established theory that matter cannot pass from the solid to the liquid state without absorbing heat; but where does the heat come from? From surrounding bodies, and that is why it freezes the ice cream, which is one of the surrounding bodies. When salt is put into a pump in which the water is frozen, the heat is abstracted from the surrounding pump barrel to melt the ice.—C. E. S., of N. H.

CASTING HOLED PATTERNS.—D. W. W., January 1st, asks what is the best method of making a casting with a hole 10 or 12 inches long, ½ or ⅝ inch cross section? If it is possible to make the mold so that the core will stand vertically, a common dry sand core will answer; but if not convenient to do so, I would take a piece of ⅜ inch iron, the proper length, including core prints; take some melted tallow and draw two streaks, one on each side of the rod, dip it in clay wash, then cover with core sand to the proper shape and dry it; and as it dries, the tallow melts out, leaving two small vents to take the air off the core. I think a core made in this manner will be strong and safe, and will not blow.—R. J. McI., of N. Y.

TEST FOR CALOMEL.—F. D. H., query No. 1, January 1, will have some difficulty in detecting the presence of calomel, as distinguished from other salts of mercury. If he merely wishes to ascertain whether mercury in any form exists in his preparation, let him mix a little, of the compound to be tested, with ether, and rub it on a bright surface of copper. The amalgamation of the metals will produce a white film on the copper. Calomel is the submuriate of mercury, and to distinguish it, from corrosive sublimate (bichloride of mercury) or other mercurial salts, will require an investigation by an experienced analyst.—D. B., of N. Y.

BLACK INK.—Some time ago a querist asked how to make Arnold's writing fluid black when first written. I have not seen the question answered. Having written to the manufacturers about it, they reply: "It is impossible to manufacture our fluid so as to write black at first, without destroying the specialty of the ink altogether." But by mixing with Rhodes' (London) or Blackwood's (London) ink, it may be made quite dark when first used.—A. F. S.

ANNEALING LAMP CHIMNEYS.—R. L. B. asks if there is any simple process for annealing lamp chimneys. If he will put his chimneys into a kettle of cold water, and gradually heat it until it boils, and then let it as gradually cool, the chimneys will not be broken by the ordinary fluctuation of the flame of the lamp.—C. E. S., of N. H.

PLOW HANDLES.—Query No. 14, January 1st.—I have seen this thing done with entire success, but cannot explain without writing at length and using cuts. The main idea is, however, clamping a strip of band iron on the outer surface of the handle while bending, so as to prevent slivers from starting, or the grain of the wood breaking. The band to remain till the wood is cold.—R. S. B.

DETECTION OF CALOMEL.—Answer to F. D. H.—Place upon a piece of clean, bright copper one drop of any liquid suspected of containing any mercurial preparation, then add a few grains of iodide of potassium; upon stirring the liquid with the point of a steel blade, the mercury (if any be present) will be precipitated, forming a silver white spot. If pills are operated with, make a paste with water, and proceed as above.—C. D. L., of O.

LEATHER BELTING.—Dry or damp air will not affect belts if they are properly cared for. Thirty years experience in a woolen factory has taught me that leather belts should be filled with currier's oil, and should be slipped off and remain so during each night. Belts kept in that way do not require to be kept so tight as those which are used dry, to do the same work, thus saving friction and wear. I have in my mind now a belt which I put together twenty-five years ago—two, in fact—eight inches wide and thirty feet long, that, when made, I literally filled with oil, and they are doing good service now.—R. S. B.

BACK PRESSURE IN EXHAUST PIPE.—For the benefit of R. K., Vol. XXVI., page 9, I would say that: if the exhaust from an engine 12 by 22 inches, making 65 revolutions per minute, pressure of steam 80 pounds, cut off at 15 inches, passing through 18 feet of 4 inch pipe to a large tank or heater, then through 220 feet of 4 inch pipe with 11 elbows to a T, then through two lines of 3 inch pipe, one 210 feet long with 18 return bends and 10 elbows, the other 225 feet long with one return bend and 10 elbows: the back pressure at the engine is 1¼ pounds, which is imperceptible in the working of the engine. The exhaust is the most economical.—E. P. D., of Me.

FLOW OF WATER AGAINST ATMOSPHERIC PRESSURE.—There is a reservoir 500 feet square, situated on the top of a hill, 80 feet above a city. What would be the effect if an airtight head could be put in that reservoir? Could water be drawn from that reservoir? What would be the effect if an air pump were applied and all the air exhausted from the reservoir?—G. M., of Mass. *Answer:* If a vacuum be created above the water, the latter would flow till the pressure of the atmosphere on the outlet was exactly balanced. If there be some air above the water, the weight of that air would cause a corresponding additional quantity of water to flow before the equilibrium was arrived at.

REVOLUTION OF BODIES.—In answer to R. O. H.'s squirrel problem (query 18, December 16th), I would say that a person cannot pass round an object without passing all sides of said object. It seems to me, therefore, that the man does not go round the squirrel, from the simple fact that he is continually on the same side of the little animal. The man goes round every fixed object within the circle which he describes, but not round any object which may be moving in the same line of radius with himself. If myself and friend walk side by side round a circle—he being nearest the center—I cannot see how I can be said to go round my friend. The circle may be as large as a race course or as small as a few feet in diameter. I therefore conclude that the man does not go round the squirrel, but that man and squirrel both go round the tree.—H. L., of N. Y.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

CENTRIFUGAL FORCE.—G. W. T.

FIREPROOF BUILDINGS.—B. A. J.

FIREPROOF SAFES.—R. S. S.

FLIGHT OF BIRDS.—S.

FUZEE vs. GOING BARREL.—J. M.

MINERAL PAINT.—E. B. H.

PSYCHIC FORCE.—J. A. S.—P. J. C.

TRACTION ENGINES.—W. C. O.

WATER IN ICE HOUSES.—E. H. B.

ANSWERS TO CORRESPONDENTS.—L. N. L.—M. B.—W. H. R.—H. A. W.—S. C.—A. S. A.

QUERIES.—C. H.—J. C. P.—G. G.—J. E. R.—G. S.—E. R.—L. F. B.—N. S.—J. N. J.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

ADVERTISING ALBUMS.—William S. Gavan, of Savannah, Ga.—This invention relates to a new construction of a book for receiving pictorial decorations and advertisements, and has for its object to permit the cards, sheets, or pictures to be properly embedded in the leaves of the book, and to make said leaves strong and durable at the edges. The invention consists in making the leaves of blotting paper sufficiently soft to enable the cards to be embedded, and in binding the edges of the leaves with thin sheet metal, which is fastened in place by sewing.

DENTAL FORCEPS.—Leonard George Haskins, of Newport, N. Y.—This is an improvement which consists mainly in reversible jaws, constructed and arranged to operate in combination with the handles of dental forceps. By making the jaws thus detachable and reversible, a single pair may be adapted to most dental purposes; but a variety of jaws suited for all the purposes for which dental forceps are used may be fitted and made reversible in a single pair of handles.

WATERING DEVICE FOR RAILROADS.—Danforth Cheney, of Brookfield, Miss.—This invention relates to a new water crane for supplying locomotives on railroad tracks, and consists in a novel arrangement of parts whereby the discharge pipe is double jointed and extensible. The crane is to be set up between two tracks, and can be swung to either side to be used. The invention consists in a new construction of universal joint for the weighted discharge pipe, and in a new manner of making said pipe extensible, and packing the joint; also, in a new general combination of parts, calculated to render the crane more convenient in use than others hitherto employed.

PAPER FOR PACKING.—Albert L. Jones, of New York city.—The object of this invention is to provide means for securely packing vials and bottles with a single thickness of the packing material between the surfaces of the articles packed. It consists in paper, card board, or other suitable material corrugated, crimped, or bossed, so as to present an elastic surface by reason of such corrugated, crimped, or bossed surface, which is a protection to the vial, and more effective to prevent breaking than many thicknesses of the same material would be if in a smooth state like ordinary packing paper. Instead of wrapping the vials or bottles with the corrugated material, the latter may be made into packing boxes, so that the vial or bottle may be surrounded by the same elastic surface. This packing may be used to advantage for various purposes, and any material or substance, besides paper and past board, which can be corrugated for this purpose, may be used.

ROTARY ENGINE.—Truckson S. La France, of Elmira, N. Y.—This invention consists in an improved arrangement of packing for rotary engines, in which a pair of toothed wheels meshing with each other is employed, the packing being a concave plate for each wheel set into the case to act against the ends of the teeth and prevent the escape of steam from the receiving port over the teeth, the said pieces being arranged to be held against the said teeth by the elastic pressure of steam or springs.

APPARATUS FOR DISTILLING SPIRITS.—Gott-hard Kleiner, of Georgetown, Mo.—This invention relates to a new and important improvement in apparatus for distilling alcoholic liquors; and consists in a series of chambers, analyzers, and condensers, with the parts connected therewith and attached thereto arranged to operate as described, for which the inventor claims advantages as follows: "First, I can make stronger by first distillation than by the ordinary apparatus. Second, I therefore save much cooperage, which is expensive. Third, I further save a large amount of warehousing, which is a heavy item. Fourth, I further save, daily, gaugers' fees and warehouse stamps. Fifth, I am not troubled with low wines, which would require tubs, pumps, etc. Sixth, I can distil twice as much beer in the same time as by the ordinary method. Seventh, there will only one meter be needed, which also is a great saving. Eighth, I save money in handling a less number of barrels than would be required for a lower proof spirit. Ninth, I thus save freight in shipping. Tenth, it will be a benefit to the government, as more spirits can be manufactured. Eleventh, I can sell my spirits at the same price as other distillers can and make greater profits. Twelfth, it is much easier and pleasanter for the distillers to work this improved apparatus than the old.'

WASHING MACHINE.—James F. Cheesebro, of Trenton, N. J.—This machine is of the class in which a dasher is made to rotate vertically several times in one direction and then reverse its motion. The inventor claims great results, by his arrangement of the several parts of the machine, which are covered by four claims.

MANUFACTURE OF BARN FORKS.—Calvin T. Beebe, of Jackson, Mich., assignor of one half his right to Elihu Cooley, of same place.—The object of this invention is to produce a four tined hay fork from a suitable piece of steel, so that the fork shall have a solid shank and the tines be arranged so as to render the barn fork more convenient and more durable than it has hitherto been.

MACHINE FOR SAWING MARBLE DIAGONALLY.—Henry S. Gillette, New Preston, Conn.—This is an improvement in that class of marble sawing machines which created such a sensation among inventors several years ago by a reward of $10,000, offered by a Vermont quarryman, for a machine for accomplishing what this is alleged to perform, namely, the sawing of a block of stone or marble on both sides at once, the cuttings being oblique or parallel to each other as may be desired, each saw being independent of the other in its adjustment.

PISTON FOR PRINTING PRESS.—Calvert B. Cottrell, Westerly, R. I.—This invention consists in improving the construction of pistons which are reciprocated in cylinders, and employed to form air cushions to arrest, at each movement, the reciprocating table of a printing press bed. The object is to prevent stoppage by paper getting between the piston and cylinder, and to allow the piston to be wholly withdrawn from the cylinder, and yet readily re-entered. Thus it will be easily relieved of any obstruction. A flexible packing is clamped between disks and expanded by a flat spring coiled around one of the disks, the flat spring being controlled by the spring pins and auxiliary springs, combined and applied together as and for the purpose set forth.

SASH HOLDER.—Thomas R. Hubbard and William L. Hubbard, Brooklyn, N. Y.—To a screw plate, of rectangular or oblong form, designed to be secured to the window frame or casing, a hollow cylinder or tubular socket is attached, in a diagonal position. This cylinder is closed at its upper end, open at its lower end, and provided with a straight, longitudinal slot, which permits the application of the finger to move the ball upward out of contact with the sash when it is desired to lower the latter, and is yet sufficiently narrow to prevent escape of the ball. The lower end of the cylinder being cut diagonally or straight with the screw plate, the lower side thereof forms a rest for the ball when allowed to come into frictional contact with the sash, which, in turn, serves to prevent the escape of the ball from the socket so that, while the sash may be raised at any time without hindrance from the ball, it cannot be lowered until the ball be moved upward in the socket.

CLAMP FOR HOLDING TIMBER.—Peter Scholl, Cashtown, Pa.—This invention is a new and convenient device for holding timber to be sawed, tenoned, hewed, or otherwise shaped or prepared for use in fences or other purposes; it consists in the arrangement of a hinged jaw on a fixed post, and in the connection therewith of a lever for setting the jaw.

CHIMES FOR REED AND PIPE ORGANS.—Carl Lehnert, Boston, Mass.—This invention consists in having the steel bars or plates used for chimes in pipe and reed organs and other instruments flanged at each edge to improve and strengthen the tones of said plates, which have heretofore been only used in plane flat form.

PROPULSION OF CANAL BOAT.—Thomas James Burke, Virginia, Ill.—This invention is an improvement in the class of canal boats propelled by apparatus consisting of endless chains carrying vertical buckets, and running from end to end over the deck and under the bottom. The improvement pertains particularly to the means of imparting motion to such propelling apparatus; and to this end consists in the arrangement of a pair of rollers and chains thereon (the latter being provided with projections), in relation to the bucket chains. It is claimed to constitute a very simple, durable, strong, and efficient mechanism.

PITMAN CONNECTION FOR HARVESTER.—Amos Ketchum, Estherville, Iowa.—The object of this invention is to provide a pitman connection for harvesters and other machinery which will be positive in its action and cannot work loose. The crank pitman is provided with prongs and pointed screws at one end, and a bolt and tube at the other, combined with the sickle bar and crank wheel, all being constructed and arranged so as to operate in the positive manner claimed.

COMBINED FRICTION AND RATCHET CLUTCH.—Abijah Whitney Hall, Northfield, Vt.—The inner surface of the projecting rim of a pulley is made slightly conical to receive the slightly conical face of the head of a clutch. The clutch is connected with the shaft by a tongue and groove, so that it may be moved longitudinally upon the shaft; but both clutch and shaft must revolve together. The outer end of the clutch is grooved to receive the end of the lever by which it is moved. To the inner surface of the outer edge of the projecting rim of the pulley are attached two (more or less) lugs or ratchet teeth, upon which an equal number of lugs or ratchet teeth, formed upon the outer side of the head of the clutch, take hold.

HASP LOCK FOR CAR.—William D. Heister, Newton Hamilton, Pa.—This invention relates to the manufacture of car locks in which, by a combination of circular and vibrating tumblers, the lock is claimed to be made very safe, so that it cannot be opened by the ordinary fraudulent means.

BEE HIVE.—Wriley W. Dodson and John B. Bray, of Lynnville, Tenn.—The object of this invention is to simplify the construction of bee hives, and while adapting them to the habits of the honey bee, and rendering them convenient for the management of the bees, to greatly reduce cost in labor and material. This hive is very simple in all its parts, and may be constructed at slight expense by any one acquainted with the use of joiners' tools. The principal feature of the invention is a peculiar lever platform applied to a bee hive, for the purpose specified.

VAULT COVER LOCK.—Andrew Richardson, New Brunswick, N. J.—This invention consists in the application to a vault cover or trap door, or any like cover or top requiring to be fastened on the outside, of an automatically locking catch adapted to be locked by gravity when the cover or door is let down. The improved automatic fastenings or locks are more especially designed for locking the coal vault covers in sidewalks, and the trap doors on the roofs of houses. To the lower side of the round cover of the hole in the permanent cover, near one edge, is pivoted a T catch, so that one end will swing under a flange of the permanent cover, or other permanent stop to lock the round cover. To prevent it from tilting and swinging, a swinging locking catch, with a notch, is arranged to engage the arm of the T catch, as soon as said catch comes to a vertical position. This locking catch takes effect by the action of gravity, which maintains it in the locked condition, and makes it impossible to raise the cover at the upper side until the catch is lifted off by hand. This simple contrivance is less expensive than the chains commonly used, besides being altogether better.

BOLT AND NUT THREADING MACHINE.—Frank S. Allen and Charles F. Ritchel, of New York city.—By this arrangement of two sets of cutters or taps, two movable frames and holders, and the screws for operating the sliding frames, the capacity of the machine is doubled as compared with a machine having cutters or taps at one end only. The number of tools that may be used in each gang is almost unlimited; hence, by the employment of serial crank mechanisms and duplicate gangs of tools, this machine is calculated to greatly reduce the cost of this kind of work. It is immaterial whether taps are used with one gang of shafts and cutters with the other, or all taps or cutters; but, for providing threaded nuts to match the bolts, the machine is adapted for cutting bolts at one end and nuts at the other.

SASH HOLDER.—Raphael Moris Seldis, of New York city, assignor to himself and John H. Trusty, of same place; assignors to John H. Trusty.—This invention pertains to improvements in the class of window sash holders, wherein friction rollers are employed in connection with corrugated or notched plates, applied to the window frame. The invention consists in an arrangement of rubber rollers and corrugated metal strips in the window frame.

CHURN.—Wesley Fritts, of Flanders, New Jersey.—This invention relates to a new churn power, intended to reduce the labor of churning, by permitting it to be performed in a most convenient position of the operator. The invention consists principally in the combination of a vibrating frame, which is worked by the hands and feet of the operator, with a pitman and crank shaft, the operator being seated while at work.

COW BELL STRAP.—Joseph H. Hughs and Absalom Hughs, of Wautoma, Wis.—This invention relates to improvements in the construction of metal straps for suspending cowbells from the necks of animals; and it consists in making an elliptically shaped strap of two pieces of thin metal, bent into a semi-elliptical form, and joined at the inner axis by hanging one end of each and connecting the other ends, by a staple on one passing through a slot on the other

HORSE HAY RAKE.—J. George Lockwood, of West Davenport, N. Y.—This invention has for its object to furnish an improved device for raising the rake teeth from the ground to discharge the collected hay, and which may also be used for holding the rake teeth to the ground while collecting the hay; and it consists in the construction and combination of the various parts of the device with the parts of the rake, so that the driver, by pressing a crank forward with his foot, forces a crank arm up against the end of an arm, which thus holds the rake teeth down to the ground. By pressing the crank to the rearward with his foot, he raises the rake teeth from the ground as the machine is drawn forward and discharges the collected hay.

JAPANNED FURNITURE SPRING.—J. Joseph Eagleton, of New York city, Sarah N. Eagleton, administratrix, assignor to Eagleton Manufacturing Company, of same place.—The helical springs heretofore employed for furniture seats, mattresses, etc., have generally been made of iron wire, brass or copper; but steel wire, although a far superior material for such springs, has not been commonly employed, owing to the lack of means of protection from corrosion, and the difficulty in imparting to them the necessary stiffness or temper. The object of this invention is to produce steel furniture springs protected from corrosion, and suitably tempered and stiffened. A suitable quantity of steel wire, of the size of which the spring is to be made, is wound upon blocks in the usual manner, giving the wound spring the ordinary pressing or set. A suitable bath contains the ordinary preparation of japan varnish, in which the springs are placed, so as to cover them with the japan. They are then removed and strung on wires or put on pegs to drain, after which they are placed in a baking oven of the ordinary kind, suitable for the baking of japanned articles, in which oven the springs are subjected to a temperature sufficient to bake and harden the japan; after which the springs are removed from the oven and allowed to cool, when they are ready for use. The inventor claims that springs, thus prepared, are strengthened or stiffened, the application of heat to the springs in the oven having the apparent effect to temper the steel of which they are composed, making the springs stronger and more elastic.

COTTON PLANTER.—Henry A. Ridley, of Jacksonport, Ark.—This is an improved machine for planting cotton seed, dropping the seed regularly and uniformly and covering it to any desired depth. This invention consists in a bottomless hopper provided with notches on the lower edge of rear side, combined with a revolving cylinder serving as bottom of hopper, and provided with spirally arranged pins to produce an unbroken and continuous delivery of seed into the spout.

COTTON CHOPPER.—Ashley G. Powell, of Smithfield, N. C.—This invention relates to means for chopping or cutting out from the rows of cotton a portion of the plants, leaving such as it is desired to bring to maturity; also means for destroying weeds and raking them, as well as the destroyed cotton plants, from the soil. It consists in a combination of devices by which as the machine moves forward, the knife is given a vibrating motion in a direction at right angles with the advance motion of the machine. The knife strikes into the soil at each vibration, having much the action of a hoe used by hand, cutting out at each stroke a certain width in the row of plants at uniform intervals.

MECHANICAL MOVEMENT.—Alexander Wallace, Jacksonville, Fla.—This invention is an ingenious and beautifully working device for avoiding dead centers in the crank movement. The principle of action seems so mathematically correct and so mechanically effective that the only wonder is why it was not discovered before.

COMBINED TOOL.—John W. Currier, Newbury, Vt.—This invention consists of the combination in one instrument of the following tools, viz: A belt or eyelet punch, can opener, pipe tongs, pliers, screw driver, nail puller, wire cutting device, and wrenches.

PROPULSION OF VESSELS.—Charles Mickle, of Guelph, Canada.—The object of this invention is intended to overcome some of the objections to the ordinary side wheels of steamboats, as well as to provide efficient means for propelling canal boats without creating such an agitation of the water as to wash the banks of the canal. It consists in applying reciprocating reversible floats for that purpose either on the sides or beneath the stern, bow, or keel, the construction and arrangement being quite unique. In applying the improvement to a canal boat, the floats may be made to work through a well hole in the bottom of the boat, and the arrangement may be such that the floats may be raised and lowered, or adjusted, according to the depth of water or draft of the boat. The floats are, of course, intended to be submerged, and it is believed that they will work without producing such an agitation on the surface of the water as will wash the banks of a canal or be in any way objectionable. The floats may probably be made to work at the stern of a a canal boat to the best advantage, either through a well hole or beneath the bottom.

FEED DEVICE FOR HULLING MACHINE.—David Kahnweiler, of New York city.—Letters patent of the United States bearing date of March 29, 1870, were issued to this inventor for an improved hulling machine. Such a machine is adapted for use in the manufacture of cotton seed oil, for which purpose it was designed; but its construction is too complicated, and the adjustment of the cutting knives is too difficult for farm or plantation use. The object in the present invention has been to simplify the construction of the machine so that it would be managed, and the knives be adjusted, by laborers of ordinary intelligence, while greatly lessening the cost.

STEAM BOILER FLOAT VALVE.—John Peters, of Haverstraw, N. Y.—The object of this invention is to produce a simple and positively acting valve arrangement within a steam boiler for giving notice when the water is too high or too low. The invention consists in the arrangement of a screw valve connected with a float or weight in such manner that the up and down motion of the latter will turn, and thereby longitudinally adjust the valve.

ELEVATOR.—Henry S. Stewart, of Yreka, Cal.—This invention has for its object to furnish an improved elevator, so constructed that the buckets will discharge their contents centrally or close to the upper driving shaft, thus especially adapting it for raising water, dirt, and other substances in mines and other confined situations, and which may be conveniently taken apart for slackening or tightening the endless chains, detaching buckets, transportation, or other purposes. This construction allows any of the links to be taken out when desired, with their attached buckets, or the chains to be parted for transportation or other purposes. The construction of the buckets causes them to discharge their contents before they have quite reached the tops of the upper chain wheels instead of after they have come to the top, so that the spout, to receive and carry off the substance raised, may be placed within the upper part of the chains.

CHURN DASHER.—Andrew T. Still, of Baldwin, Kan City.—This is an improved dasher so constructed as, it is claimed, to bring the butter in a very short time, and with a comparatively small amount of labor, and which will keep the milk thoroughly mixed with air while being churned. With this adjustment, as the dasher is revolved, the milk will be forced through tubes, and will be projected upwards by the inclination of the tubes, and at the same time projected outwards by the centrifugal force engendered by the revolution of the dasher, so as to dash against the sides of the churn, thus throwing the milk into violent agitation, thoroughly mixing it with the air, and bringing the butter in a very short time.

PORTABLE FIRE ESCAPE.—George D. McCullen, of New Orleans, La.—This invention has for its object to furnish an improved fire escape, for the removal of women, children, and other feeble and timid persons from the burning buildings, so constructed that it may be conveniently kept in the house and moved from place to place with the same facility as any other piece of furniture. A box is made of such a size as to receive the car or chair. The box should be mounted upon casters so that it may be conveniently moved from one part of the room to another, and should be weighted or ballasted with lead, iron, or other heavy material to hold it securely in place when in use. The cover of the box is firmly hinged at one of its end edges, and is turned back to project from a window and rest upon the lower part of the window frame when the apparatus is to be used. The cover has rollers attached to the outer and inner parts of its under side for the lowering and hoisting rope to pass over. A roller is attached to the box to receive the said rope. The car is made of such a size as to receive one or more persons, and with its front, sides, bottom, and the lower part of its rear inclosed, the top and upper part of its rear being left open. The interior of the car or chair is provided with a seat for the convenience of the person or persons being lowered, and may also be provided with one or more short staves, finished like a boat hook, to enable the person or persons to push the car or chair back from the wall while being lowered. The rear edge of the sides of the car or chair are also recessed for convenience in passing over cornices, the edges of awnings, etc. The whole is lowered by a system of wheels and axles with a rope or chain.

SECTIONAL STEAM GENERATOR.—Dewitt C. Howell, of Goshen, N. Y.—The generating tubes are arranged in tiers in an inclined position, so that they cross each other. There may be more or less in number of these tiers, and more or less tubes, of any desired length and diameter. The tubes of each tier may be placed, as regards each other, nearer together or further apart, as may be deemed best. The heads or tube sheets are made in sections, so that the generator may be made wider and more capacious, or smaller, as may be required. Return chambers (above the two lower chambers) receive the water from two tiers of tubes, which conduct the water in opposite directions. These chambers are attached to the heads by means of bolts or screws, and are packed or fitted to a steam joint with the heads. The feed water is pumped into one or both of the two lower chambers, and is forced up through the different tiers of tubes; but the water which starts from the chambers of one head is returned to the lower chamber of the other head by means of the return tubes. The steam generated is discharged into two upper chambers through two upper tiers of superheating tubes, and finds its way into the steam drum. Diaphragms are placed between the tiers of tubes for controlling and regulating the passage of the products of combustion. There are vertical partitions in the steam drum against which the currents of steam or steam and water (in case of foaming) impinge as they are discharged into the drum. Any water which may be carried over through the pipes will, on striking the partitions, fall by its own gravity and settle in the bottom of the drum. A pipe may extend from the bottom of the drum and connect with the feed water pipe for conducting off this water. There is an outside vertical tube connecting with the steam and water spaces of the generator, so that the water therein will not be materially affected by the motion of the water in the generating tubes. The gage cocks are placed [illegible] this tube. The front end of the generator is stationary, and fixed in position by front arch plates.

TRUNK LID SUPPORT.—George H. Johnson and Fred. Bottner, of Bridgeport, Conn.—The object of this invention is to provide suitable and convenient means for supporting the lids or covers of trunks, chests, and boxes; and it consists in a hinged rod and guide plate for supporting the cover. The rod and the guide plate are let into the end of the trunk and the cover, so that they form no obstruction to tightly closing the trunk. When the cover is raised, the rod forms a brace which holds in both directions. To lower the cover it is simply necessary to raise the ends of the rod or rods from the recesses, when, as the cover closes, the ends of the rods slide in or on the guides and are brought down parallel with the top of the trunk.

AMALGAMATING ORES.—John Tunbridge, of Newark, N. J.—Two vessels are connected by a pipe and provided with screens at different altitudes. The ore pipe has a check valve, connected with a vertical discharge pipe having a cock. One of the two vessels is filled to the connecting pipe, or nearly so, with quicksilver, while balls of granulated amalgam, or some composition for the same purpose, are placed upon the sieves in the other vessel. The mode of operation is as follows: Power is employed in connection with the ore pipe to force the ore washings through it, the check valve opening inward and yielding to any force exerted through said pipe. The washings then pass up through the quicksilver in the first vessel, and are subdivided in passing through the screens; they are then forced through the connecting pipe into the second vessel and pass down through the amalgam balls and screens, and are discharged. The effect produced upon the ore is to abstract the principal part of the metal in the first chamber and the greater part of the residue while passing through the amalgam balls.

Inventions Patented in England by Americans.

From December 6 to December 11, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.]

BOOT SEWING MACHINE.—L. R. Blake, Fort Wayne, Ind.

CENTRIFUGAL DRYING MACHINE.—H. W. and R. Lafferty, Gloucester, N. J.

FIRE ESCAPE.—G. D. McCullen, New Orleans, La.

PREPARING GRAIN.—L. S. and C. F. Chichester, Brooklyn, N. Y.

ROTARY STEAM ENGINE.—M. Schwartz, Bangor, Maine.

SEWING MACHINE.—S. W. Wardwell, Jr., St. Louis, Mo.

WIRE WORK.—S. Colt, Hartford, Conn.

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Vessels, apparatus for raising coal from sunken, R. W. Dugan 122,309
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Wagon pole, device for steadying, R. A. Seaders 122,334
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Whiffletree, safety, A. H. McAllister 122,394
Winding machine, guide and cleaner for, J. Fullan 122,450

EXTENSIONS GRANTED.

18,882.—IMPROVEMENT IN SNOW PLOWS, granted to Newcomb Demary, Jr., December 15, 1857.

18,959.—IMPROVEMENT IN SEEDING MACHINES, granted to William Coggeshall and Bennet B. Warner, December 29, 1857.

18,872.—Reissue No. 3,138.—IMPROVEMENT IN BORING MACHINES, granted to Lafayette Stevens, December 15, 1857, and reissued September 22, 1868.

18,945.—MODE OF LIGHTING GAS BY ELECTRICITY, granted to Samuel Gardiner, Jr., December 22, 1857.

18,942.—IMPROVED METHOD OF GOVERNING THE CUT OF CIRCULAR SAWING MACHINERY, granted to A. C. Martin and William H. S. Ewell, Administrator of M. M. Wombaugh, deceased, December 22, 1857.

18,975.—Reissue No. 3,460.—IMPROVEMENT IN MOWING MACHINES, granted to Silas C. Jackson and Morgan P. Jackson, December 29, 1857; reissue May 25, 1869.

18,906.—Reissue No. 4,171.—MACHINE FOR ROLLING CORNICE, granted to Asa Johnson, December 22, 1857; reissued November 1, 1870.

DESIGNS PATENTED.

5,452.—STOVE PLATE.—Philo D. Beckwith, Dowagiac, Mich.

5,453.—HEATING STOVE.—Philo D. Beckwith, Dowagiac, Mich.

5,454.—FIRE POT OF A COAL STOVE.—Philo D. Beckwith, Dowagiac, Mich.

5,455.—BLACKBOARD.—Malcomb McVicar, Potsdam, N. Y.

5,456.—TYPE.—Richard Smith, Philadelphia, Pa., assignor to MacKellar, Smiths & Jordan, same place.

5,457.—FRAME FOR A MIRROR.—William G. Cross, Philadelphia, Pa., assignor to Hall and Garrison.

5,458.—TRIMMING.—Frederick A. Kursheedt, New York city.

5,459.—TRIMMING.—Frederick A. Kursheedt, New York city.

5,460.—TRIMMING.—Frederick A. Kursheedt, New York city.

5,461.—SHOW CASE.—William H. Reiff, Philadelphia, Pa.

TRADE MARKS REGISTERED.

608.—COFFEE POT.—John Ashcroft, Brooklyn, N.Y.

609.—PERFUMES, SOAPS, ETC.—Deniker & Melville, New York city.

610.—BOOTS AND SHOES.—Hosea B. Edgerly, Farmington, N. H.

611.—MEDICINE.—H. G. G. Fink, Pittsburgh, Pa.

612.—BIBLES.—Andrew J. Holman, Philadelphia, Pa.

613.—SHIRTS.—Miller and Brother, Philadelphia, Pa.

614.—SUBSTITUTE FOR LINSEED OIL, ETC. E. Murdock, Jr., Winchendon, Mass.

615.—DRESSING FOR LEATHER.—Elihu B. Palmer, Boston, Mass.

616.—GIN.—Seth E. Pecker & Co., Boston, Mass.

617.—OIL OR SOAP.—J. M. Ball & Co., St. Louis, Mo.

618.—SPICED SALMON.—Isaac Rich & Company, Boston, Mass.

619.—WROUGHT IRON GOODS.—J. Rogers, Jay and Au Sable Forks, and J Rogers, Black Brook, N.Y.

620.—WINES AND LIQUORS.—E. Simpson & Co., New York city.

621.—ARTISTS' MATERIALS.—Charles P. Staab, New York city.

622.—PASTILLES.—Stowell & Co., Charlestown, Mass.

623.—WHEAT.—James E. Weaver, Havelock, Pa.

624.—STOVES.—William J. Keep, Troy, N.Y.

625.—STOVES.—William J. Keep, Troy, N.Y.

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

19,119.—STEAM ENGINE.—Granted to Edward D. Barrett, January 19, 1858; reissued August 29, 1865. Hearing January 3, 1872.

19,206.—HYDRANTS.—Granted to Washburn Race and S. R. C. Mathews, January 26, 1858; reissued July 18, 1871. Hearing January 10, 1872.

19,347.—INDIA RUBBER DOOR MATS.—Granted to Edwin M. Chaffee, February 16, 1858. Hearing January 31, 1872.

19,147.—ICE CREAM FREEZERS.—Granted to H. B. Masser, January 19, 1858. Hearing January 3, 1872.

19,137.—HARVESTERS.—Granted to Ezra Emmett, January 19, 1858. Hearing January 3, 1872.

19,490.—METALLIC TIES FOR COTTON BALES.—Granted to Frederick Cook, March 2, 1858. Hearing February 14, 1872.

19,222.—SEED PLANTERS.—Granted to James D. Willoughby, January 26, 1858. Hearing January 10, 1872.

19,191.—MAKING BLADES FOR PENCIL SHARPENERS.—Granted to Walter K. Foster, January 26, 1858. Hearing January 10, 1872.

19,328.—CANE GUNS.—Granted to J. F. Thomas, February 9, 1858. Hearing January 24, 1872.

19,252.—PLATE FRAMES FOR PHOTOGRAPHIC CAMERAS.—Granted to William Lewis and William H. Lewis, February 2, 1858. Hearing January 17, 1872.

19,200.—STRAW CUTTERS.—Granted to Jacob H. Mumma, January 26, 1858; reissued September 6, 1859, March 29, 1864, and March 7, 1865. Hearing January 10, 1872.

19,465.—CARPET BEATING MACHINE.—Granted to Joseph Harris, Jr., and Daniel Holmes, February 23, 1858; reissued May 13, 1862. Hearing February 7, 1872.

19,258.—FLASKS FOR CASTING WHEELS.—Granted to Frederick Nishwitz, February 2, 1858. Hearing January 17, 1872.

19,321.—PLOWS.—Granted to George Watt, February 9, 1858; additional improvements August 2, 1859; reissued August 4, 1868. Hearing January 24, 1872.

19,696.—GRINDING ATTACHMENT TO PUG MILLS.—Granted to David H. Gage March 23, 1858. Hearing March 6, 1872.

19,318.—LAP JOINTS FOR BELTING.—Granted to Henry Underwood, February 9, 1858; reissued January 1, 1867. Hearing January 24, 1872.

19,384.—BANK CHECK CANCELER.—Granted to William M. Simpson, February 16, 1858. Hearing January 31, 1872.

19,370.—KNITTING MACHINES.—Granted to Joseph K. Kilbourn, and Edward E. Kilbourn, February 16, 1858. Hearing January 31, 1872.

19,346.—PROPELLING CANAL BOATS.—Granted to Herman Camp, February 16, 1858. Hearing January 31, 1872.

19,398.—HYDRAULIC VALVES.—Granted to Calvin Woodward and George M. Woodward, February 16, 1858. Hearing January 31, 1872.

19,377.—HARVESTERS.—Granted to Frederick Nishwitz, February 16, 1858; reissued March 5, 1861, and again reissued in two divisions April 13, 1869. Hearing January 31, 1872.

19,349.—SHINGLE MACHINES.—Granted to George Craine, February 16, 1858. Hearing January 31, 1872.

19,420.—HORSE RAKES.—Granted to William Horning, February 23, 1858. Hearing February 7, 1872.

19,462.—STRAW CUTTERS.—Granted to Thomas H. Willson and Daniel T. Willson, February 23, 1858. Hearing February 7, 1872.

19,412.—SHOVEL PLOW OR CULTIVATOR.—Granted to Paul Dennis, February 23, 1858; reissued August 4, 1863. Bearing February 7, 1872.

19,417.—COTTON GINS.—Granted to Benjamin David Gullett, February 23, 1858. Hearing February 7, 1872.

19,461.—SHOE PEG MACHINE.—Granted to Abijah Woodward, February 23, 1858. Hearing February 7, 1872.

19,555.—SPLICE FOR JOINTS OF RAILROAD RAILS.—Granted to Mark Fisher March 9, 1858. Hearing February 21, 1872.

19,979.—SEWING MACHINES.—Granted to Charles F. Bosworth, April 20, 1858. Hearing April 4, 1872.

19,497.—CONTINUOUS METALLIC LATHING.—Granted to Birdsall Cornell, March 2, 1858. Hearing February 14, 1872.

19,517.—MACHINE FOR FORMING SHEET METAL PANS.—Granted to E. A. Smead, March 2, 1858. Hearing February 14, 1872.

19,488.—HARVESTERS.—Granted to Jesse S. Butterfield, March 2, 1858; reissued in two divisions January 15, 1867. Hearing February 14, 1872.

19,572.—MACHINES FOR PACKING FLOUR.—Granted to J. Mattison, March 9, 1858. Hearing February 21, 1872.

19,610.—RAISING DOUGH.—Granted to James Perry and Elisha Fitzgerald March 9, 1858. Hearing February 21, 1872.

19,698.—COMBINED FLOATING ANCHORS AND LIFE PRESERVERS.—Granted to Joseph Humphries, March 16, 1858. Hearing February 28, 1872.

19,719.—STOP MOTION FOR HAIR CLOTH LOOMS.—Granted to Rufus J. Stafford, March 23, 1858. Hearing February 6, 1872.

19,741.—RAILROAD CAR AXLE BOXES.—Granted to R. N. Allen, March 23, 1858; reissued December 20, 1864. Hearing February 6, 1872.

19,548.—MODE OF TIGHTENING AND SECURING THE KEYS OF JOURNAL BOXES OF CONNECTING RODS OR PITMEN.—Granted to Levi Dederick, March 9, 1858. Hearing February 21, 1872.

19,619.—MACHINE FOR PLANING BLIND SLATS.—Granted to Charles Carlisle and Leonard Worcester, March 16, 1858. Hearing February 28, 1872.

20,285.—FLY NETS.—Granted to Robert Wilson, May 11, 1858. Hearing April 24, 1872.

20,298.—SASH FASTENERS.—Granted to Frederick W. Brocksieper and Joseph B. Sargent, May 11, 1858. Hearing April 24, 1872.

19,594.—VALVES FOR STEAM ENGINES.—Granted to Isaac Van Doren, March 9, 1858. Hearing February 21, 1872.

19,787.—WINDLASSES.—Granted to Joseph P. Manton, March 30, 1858. Hearing March 13, 1872.

19,806.—ROTARY CUTTERS FOR TONGUEING AND GROOVING.—Granted to James A. Woodbury, March 30, 1858. Hearing March 13, 1872.

19,637.—GRAIN SEPARATORS AND CLEANERS.—Granted to Simeon Howes and Gardner E. Throop, March 16, 1858. Hearing February 28, 1872.

19,654.—MACHINES FOR TRIMMING BOOKS.—Granted to A. C. Semple, March 16, 1858. Hearing February 28, 1872.

19,626.—PHOTOLITHOGRAPHY.—Granted to James A. Cutting and L. H. Bradford, March 16, 1858; reissued July 31, 1860. Hearing February 28, 1872.

19,693.—HOT AIR FURNACES.—Granted to John Child, March 23, 1858. Hearing March 6, 1872.

19,747.—WIRE STAPLES.—Granted to Byron Boardman, March 30, 1858; reissued March 6, 1866. Hearing March 13, 1872.

19,819.—LIGHTNING CONDUCTORS.—Granted to Oren White, March 30, 1858. Hearing March 13, 1872.

19,830.—HUBS OF CARRIAGE WHEELS.—Granted to James M. Whitney, March 30, 1858. Hearing March 13, 1872.

19,644.—SAWING MACHINES.—Granted to Henry H. Lowe, March 16, 1858. Hearing February 28, 1872.

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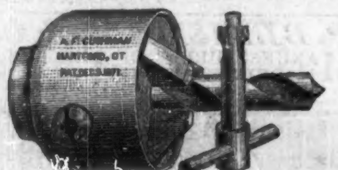

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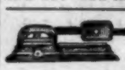

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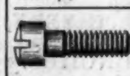

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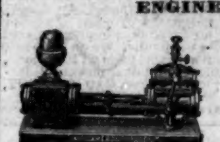

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